SOIL SURVEY

Burlington County New Jersey

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
NEW JERSEY AGRICULTURAL EXPERIMENT STATION
Issued October 1971

Major fieldwork for this soil survey was done in the period 1964 to 1966. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1966. This survey was made cooperatively by the Soil Conservation Service, the New Jersey Agricultural Experiment Station at Rutgers, the State University, College of Agriculture and Environmental Science, and the Board of Freeholders of Burlington County. It is part of the technical assistance furnished to the Burlington County Soil Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Burlington County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification and woodland group of each. It also shows the page where each soil is described.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of woodland groups.

Foresters and others can refer to the section "Use of the Soils as Commercial Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of Soils for Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section "Soils in Community Development."

Engineers and builders can find, under "Engineering Applications," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in Burlington County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of this publication.

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Soil Survey of Burlington County, New Jersey

BY MARCO L. MARKLEY, SOIL CONSERVATION SERVICE

SOILS SURVEYED BY MARCO L. MARKLEY AND RICHARD G. HUTCHINS, SOIL CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE, IN COOPERATION WITH THE NEW JERSEY AGRICULTURAL EXPERIMENT STATION AT RUTGERS, THE STATE UNIVERSITY, COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCE

BURLINGTON COUNTY, lying southeast of the Delaware River (fig. 1), has an area of about 524,160 acres, or 819 square miles. The Delaware River is navigable and tidal as it passes the county, and there are tidal flats on the southeastern tip of the county. Arneys Mount has the highest elevation, more than 240 feet.

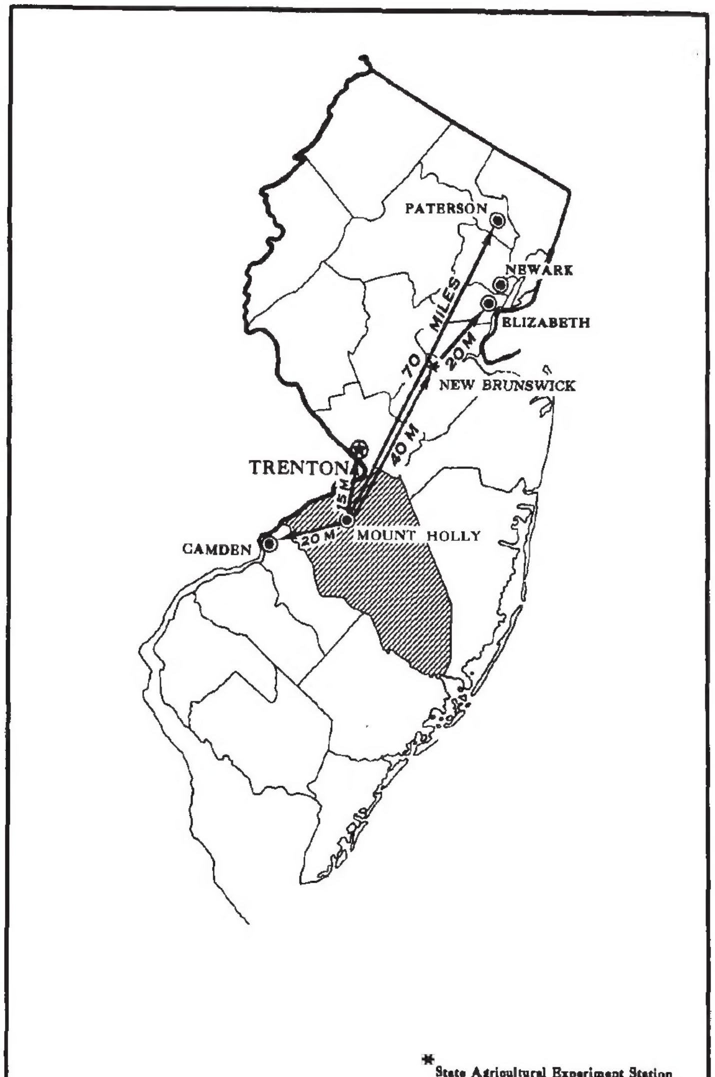

Figure 1.—Location of Burlington County in New Jersey.

The estimated population of the county in 1965 was 277,330. The population is concentrated in a strip 10 miles wide that parallels the river, and most of the industrial and commercial development also is on this strip. Recently industrial and commercial development has greatly increased along the main highways. Fort Dix and McGuire Air Force Base, sizable military bases, are in the county.

The county is about 54 percent forest, 30 percent farmland, 12 percent communities, and 4 percent federally owned land. Most of the productive farmland is in the one-third of the county that parallels the Delaware River. East of this is mostly pine woodland, where State-owned forests and parks make up 20 percent of the county.

The part of the county containing the dominantly pine forest is often called the outer Coastal Plain (*15*),[1] or the Barrens (*5*), and that part where the trees are dwarfed is called the Plains (*5*). The Plains area is indicated on the general soil map, as is the boundary between the inner Coastal Plain and the outer Coastal Plain.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Burlington County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. As they traveled over the county, they observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil

[1] Italicized numbers in parentheses refer to Literature Cited, p. 118.

series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Marlton and Atsion, for example, are the names of two soil series named for towns in Burlington County. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Freehold fine sandy loam, 0 to 2 percent slopes, is one of several phases within the Freehold series.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. A soil complex is such a mapping unit shown on the soil map of Burlington County.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Lakehurst-Lakewood sands, 0 to 5 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so shallow, or so mixed, either naturally or by man, that the soils cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called Miscellaneous land types and are given descriptive names. Urban land, sandy, is a land type in Burlington County.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

The soil scientists set up trial groups on the basis of yield and practice tables and other data they have collected. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then they adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Burlington County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and for community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The 13 soil associations in Burlington County are discussed in the following pages. Eight of these associations are in the inner Coastal Plain and five are in the outer Coastal Plain.

Inner Coastal Plain

This area contains soils that generally are finer textured than those of the outer Coastal Plain. Subsoils are dominantly fine sandy loam, sandy clay loam, clay loam, and sandy clay. Most soils have a high available water capacity and are naturally fertile. Because they formed in marine deposits containing glauconite, many of the soils of the inner Coastal Plain contain varying amounts of this mineral. Most of these soils have been cleared for farming.

1. Galestown-Klej association

Nearly level to gently sloping, excessively drained to somewhat poorly drained soils that are rapidly and moderately rapidly permeable and have a sand and loamy sand subsoil or underlying material

This association is immediately east of and adjacent to the Delaware River. Elevations are mostly below 50 feet, and slopes are less than 5 percent.

This association makes up about 4 percent of the county. About 65 percent of it is Galestown soils, 25 percent is Klej soils, and the remaining 10 percent is minor soils.

The Galestown soils are excessively drained and have a low available water capacity. Klej soils are moderately well drained and somewhat poorly

Figure 2.—**Sweet corn and peaches on Galestown sand in the Galestown-Klej association.**

drained. They occupy depressional areas. Both Galestown and Klej soils are sandy.

Minor areas in this association are of three kinds: Made lands, dredged coarse material, dredged fine material, and sanitary fill; Urban land, sandy; and Marsh, tidal.

Nearly all of the acreage of Galestown and Klej soils was cleared for farming long ago. At first general crops were grown, but lately nearly all cropland is in irrigated crops of high value, such as sweet corn and peaches (fig. 2).

A large acreage of the Galestown and Klej soils is used for community development. The riverfront communities of Palmyra, Riverton, Riverside, Delanco, Beverly, Burlington, and Florence are mainly in this association. Urban land, sandy, is mostly in residential and industrial use, and some areas of Made land have been taken for industry.

Near the Delaware River, south of Burlington and especially on Burlington Island, the soils are underlain by gravel and cobblestones. The island is currently being dredged for gravel. Some areas of the Made land are now held for future dredge deposits, and some areas of Made land, coarse material, have been reworked for gravel and sand.

Because the major soils in this association are at relatively low elevations, sand and gravel pits are excavated to the water table in places. Olympia Lakes, a popular swimming area, was developed in an abandoned pit of this kind. In contrast, Holiday Lake was formed by excavating farmland.

2. *Keyport-Donlonton association*

Nearly level to steep, moderately well drained and somewhat poorly drained, slowly permeable soils that have a clay loam subsoil

The soils of this association occupy three small areas near the Delaware River. Slopes range from 0 to 25 percent.

This association occupies about 2 percent of the county. About 55 percent of it is Keyport soils, about 40 percent is Donlonton soils, and the remaining 5 percent is minor soils.

Keyport soils are moderately well drained. They are higher and steeper than the Donlonton soils. The Donlonton soils are in low positions and are somewhat poorly drained. Both kinds of soils have a clay loam subsoil that is slowly permeable. They have a high available water capacity, but they drain slowly and warm slowly in spring.

The minor soils are mostly well drained or moderately well drained. They are sandier than the Keyport and Donlonton soils.

Except for the steeper slopes, most of this association has been cleared and is used for general crops. Because the major soils are slowly permeable and not well drained, these soils generally are not used for vegetables and fruit. The steep Keyport soils provide the only natural habitat for rhododendrons in the county (Fig. 3).

All of this association probably will be used for community development. Because of underlying clayey material and the somewhat poor or only moderately good drainage, limitations for use in septic tank disposal fields are severe. Of several areas that have been a source of clay for bricks, one extensive pit is still in use.

3. *Freehold-Holmdel-Adelphia association*

Nearly level to steep, well-drained to somewhat poorly drained soils that are moderately and moderately slowly permeable and have a fine sandy loam to sandy clay loam subsoil

The soils in this association occupy high and intermediate positions in a wide, broken belt that roughly parallels the Delaware River. The association includes extensive nearly level fields and strong to steep slopes

Figure 3.—**Natural stands of rhododendron under a hardwood forest on steep Keyport soils in the Keyport-Donlonton association.**

surrounding the knobs of Mt. Laurel, Mt. Holly, Arneys Mount, and Stony Hill. Much of the most productive farmland of the county is in this association.

The association occupies about 18 percent of the county. About 25 percent of the association is Freehold soils, 20 percent is Holmdel soils, 15 percent is Adelphia soils, and the remaining 40 percent is minor soils.

The Freehold soils occupy the higher positions in the association and the adjacent strong to steep slopes. They are well drained. Holmdel and Adelphia soils are below the Freehold soils and are mostly moderately well drained, but they range to somewhat poorly drained. They have a fluctuating water table. Most areas of these soils that were not well drained have been artificially drained. The major soils have a high available water capacity.

Minor soils include some that are clayey, wet, very sandy, or contain ironstone. Of these, the wet and very sandy soils are most extensive. Alluvial land is along the streams and is subject to frequent flooding.

Nearly all of the less sloping areas in this association have been cleared for farming. Before clearing, hardwoods were dominant. Dairy farms are common, and many also produce high-value vegetables (fig. 4). Fruit is well suited and is widely grown, though not so extensively as between 1900 and 1930.

A number of specialty farms are in this association. These include almost all of the 20 or more racing farms and training tracks of the county, as well as nearly all of the beef cattle farms. Also in this association are a number of nurseries, two extensive cultivated-sod farms, and several blueberry farms.

Community development is considerable in the western part of the association. In the northern part it is moving eastward from U.S. Highway 130 and the New Jersey Turnpike; in the southwestern part residential and industrial expansion is extensive along State Route 38, the New Jersey Turnpike, and Interstate Highway 295. The limitations to use for septic tank disposal fields are slight in Freehold soils and moderate in Holmdel and Adelphia soils.

Some sand and gravel pits have been opened around Jacobstown, Columbus, and Mansfield, and extensive pits are on the south side of Rancocas Creek.

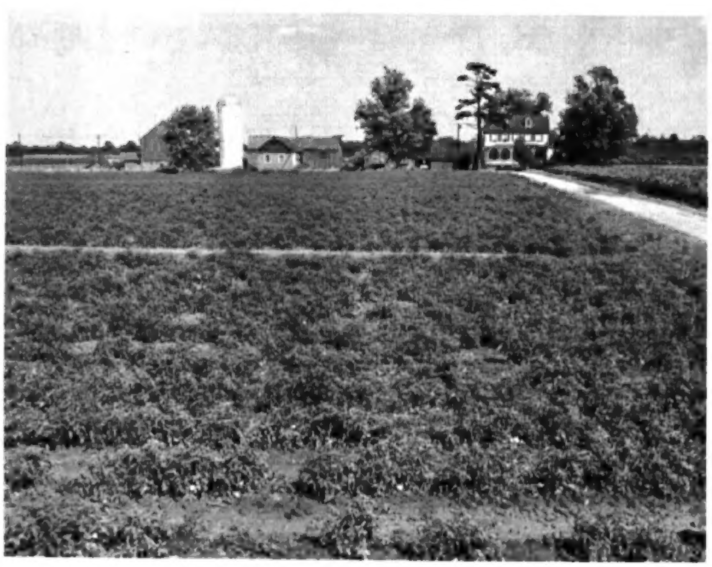

Figure 4.—Tomatoes grown on a dairy farm in the Freehold-Holmdel-Adelphia association.

4. Shrewsbury-Alluvial land, loamy-Keansburg association

Nearly level, mainly poorly drained and very poorly drained, moderately permeable soils that have a fine sandy loam to sandy clay loam subsoil, and Alluvial land subject to frequent stream overflow

This association occurs in the north-central part of the county in low areas that receive much runoff from the slopes above. These soils were normally ponded in winter and spring, but many areas have been drained. Flooding, however, remains a constant hazard.

This association makes up about 3 percent of the county. The Alluvial land and Shrewsbury soils each occupy about 40 percent of the association, Keansburg soils occupy about 10 percent, and minor soils occupy the remaining 10 percent.

Natural drainage for the Shrewsbury soils is poor, for Alluvial land, loamy, is moderately good to very poor, and for Keansburg soils is very poor. These dominant soils contain a moderate amount of sand. They can be improved by drainage in most places where an outlet can be obtained. Along the lower parts of Rancocas, Crosswicks, Assiscunk, and Blacks Creeks, Alluvial land, loamy, is bordered by steep slopes that confine the floodwaters. Toward the headwaters of these creeks and along Barkers Brook and its tributaries, the flood plains are only about 1 or 2 feet below the adjacent soils. When the rainfall is heavy, these streams overflow and the adjacent soils are flooded.

Nearly all of this association is in farms and is used mostly for pasture, hay, corn, soybeans, or woodland. Many ponds have been dug for irrigation, wildlife, and recreational purposes. Limitations to use of this association for homesites and septic tank disposal fields are severe.

5. Woodstown-Sassafras association

Nearly level to gently sloping, moderately well drained and well drained soils that are moderately and moderately slowly permeable and have a fine sandy loam subsoil

This association roughly parallels the Delaware River. It occurs on gently sloping terraces that are just east of the sandy low terrace along the river. It is about 5 miles wide in the vicinity of Moorestown but is narrower through Willingboro. A smaller area is east of Bordentown. The elevation of this association is mostly between 60 and 80 feet.

This association makes up about 7 percent of the county. About 40 percent of the association is Woodstown soils, 35 percent Sassafras soils, and the remaining 25 percent is minor soils.

The Woodstown soils are moderately well drained, but in high areas the soil is underlain by clay beds that slow normal drainage. The Sassafras soils nor-

mally are higher than Woodstown soils and are well drained.

The minor soils in this association include small areas of clayey soils, some poorly drained soils, and considerable Urban land in areas where the original soils were destroyed during residential development.

The Sassafras soils and, where adequately drained, the Woodstown soils are well suited to farming. Vegetables, fruit, and general crops are grown extensively.

Residential developments are rapidly replacing farms in the vicinity of Willingboro, Maple Shade, Cinnaminson, and Moorestown. The Woodstown soils have moderate limitations as sites for septic tank disposal fields. The Sassafras soils have only slight limitations, except where there are underlying clay layers.

6. *Colemantown-Kresson-Marlton association*

Nearly level to moderately sloping, poorly drained to moderately well drained, slowly permeable soils that have a sandy clay loam to sandy clay subsoil

This association consists of four small areas about 10 miles southeast of the Delaware River. Some parts of these areas are high, and others are intermediate or low.

This association makes up about 2 percent of the county. About 45 percent of the association is Colemantown soils, 25 percent is Kresson soils, 20 percent is Marlton soils, and the remaining 10 percent is minor soils.

The Colemantown soils are lowest on the landscape, Kresson soils are intermediate, and Marlton soils are the highest. These dominant soils formed on the highly glauconitic material that locally is called marl. They are olive colored and have a sandy clay to sandy clay loam subsoil that is slowly permeable.

Although nearly all of this association was cleared for farming, some of the wet and sloping areas have reverted to woodland. Since these soils are difficult to work, they are mostly used for general crops, hay, and pasture.

This association provided most of the "marl" that was spread on fields before 1900, but that material is no longer used. The pits are mostly covered by trees, but revegetation generally is slow.

Some of the association has been taken for residential use. Use for septic tank disposal fields is severely limited by ground water or slow permeability.

7. *Pocomoke-Pasquotank-Fallsington association*

Nearly level, very poorly drained and poorly drained soils that are moderately and moderately slowly permeable and have a sandy loam to very fine sandy loam subsoil.

This association occurs mostly in low positions at elevations from 40 to 80 feet. Most areas are poorly and very poorly drained and without a suitable natural outlet. The largest area is in the central part of the county.

This association makes up about 3 percent of the county. About 40 percent of the association is Pocomoke soils, 35 percent is Pasquotank soils, 10 percent is Fallsington soils, and the remaining 15 percent is minor soils.

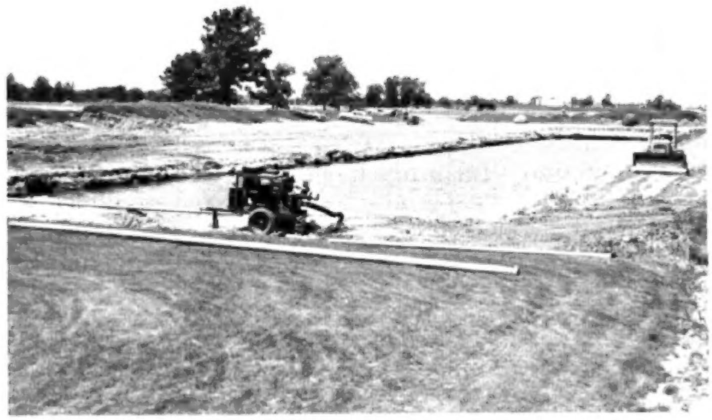

Figure 5.—**The high water table supplies large amounts of water for this dugout pond in soil association 7.**

The major soils in this association contain a moderate amount of sand. They have a high water table. The Pocomoke soils are very poorly drained, and the Pasquotank and Fallsington soils are poorly drained. These soils normally are too wet to be used for crops, but they can be improved by drainage where outlets are available. Drainage lowers the water table and reduces, but does not eliminate, the hazard of flooding.

Nearly all of this association was once cleared for crops, but some areas have reverted to woodland where drainage was neglected. The crops most commonly grown are hay, pasture, corn, soybeans, and small grains. Blueberries, a special crop, are also grown.

Because of the high water table, these soils are well suited to the construction of ponds for irrigation (fig. 5). This high water table, however, severely limits the use of these soils for farming, homesites, and septic tank disposal fields.

8. *Nixonton-Westphalia association*

Nearly level to gently sloping, moderately well drained and well drained soils that are moderately slowly permeable and have a very fine sandy loam to fine sandy loam subsoil

This association occupies four areas about 12 miles southeast of the Delaware River. Slopes range from 0 to 5 percent.

The association makes up about 3 percent of the county. It is about 40 percent Nixonton soils, 20 percent Westphalia soils, and 40 percent minor soils.

The dominant soils in the association have profiles with a high percentage of fine and very fine sand and a low percentage of coarse sands. Where the sand is loose. it is subject to blowing. Nixonton soils are below the Westphalia soils. Nixonton soils are naturally moderately well drained, but most areas have been artificially drained. Westphalia soils are well drained.

Minor soils in the association include extensive areas of Urban land, sandy, and some poorly drained soils. Urban land, sandy, consists of former Nixonton and Westphalia soils that were destroyed during the development of military installations at Fort Dix and McGuire Air Force Base.

Most of the association was cleared for farming, but some cropland has been used for residential development. The remaining farms are used mostly for vegetables and dairy farming. Residential development has spread into the association from the community of Marlton and from McGuire Air Force Base. Cropland likely will continue to decrease. Little woodland remains to replace the cropland taken for community development.

Use for homesites and septic tank disposal fields is slightly limited on Westphalia soils, and moderately limited on Nixonton soils.

Outer Coastal Plain

This area consists mostly of soils that have a very sandy surface layer and a sandy subsoil. In soil association 9, there are some extensive areas of fine sandy loam and small spots where the subsoil is clay loam or clay. Underlying layers of clay occur below a depth of 40 inches in a few places. The very sandy soils have a low available water capacity and are infertile. Except in soil association 9, farming is mostly restricted to blueberries, cranberries, and other special crops.

9. Downer-Sassafras-Woodstown association

Nearly level to gently sloping, well drained and moderately well drained soils that are moderately and moderately slowly permeable and have a sandy loam and fine sandy loam subsoil

This association occurs at relatively high elevations of about 80 to 120 feet in the central part of the county and 40 to 60 feet in the southern and eastern parts. It generally is in widely scattered areas.

This association makes up about 6 percent of the county. About 60 percent of the association is Downer soils, 20 percent is Sassafras soils, 10 percent is Woodstown soils, and the remaining 10 percent is minor soils.

The Sassafras and Downer soils are in high areas and are well drained. Downer soils are somewhat sandier than the Sassafras soils and are less well suited to crops. Woodstown soils lie below the Downer and Sassafras soils. They are moderately well drained. In most areas Woodstown soils have been improved by drainage.

The minor soils in the association are sandy. They are poorly drained in some areas.

In the Tabernacle and Indian Mills areas, the soils have been cleared for crops and are used extensively for irrigated vegetables of high value. In the Indian Mills area, the Sassafras soils are more extensive than the Downer soils. Most of the other areas are not privately owned and are mainly covered by hardwoods and pines. Some of this association is in Wharton State Forest; some is in Bass River State Forest, and one area is in the Fort Dix Military Reservation.

Community development is expected to be minor in this association in the immediate future, unless such projects as the proposed jet airport become a reality. There are some sand and gravel pits in this association, but none is extensive.

10. Lakehurst-Lakewood-Evesboro association

Nearly level to strongly sloping, somewhat poorly drained to excessively drained soils that are rapidly and moderately rapidly permeable and have a loamy sand and sand subsoil or underlying material

This association occupies high positions on the outer Coastal Plain, which is locally called the Pine Barrens (*8*). Elevations range mostly from 80 to 180 feet.

This association makes up about 22 percent of the county. About 40 percent of the association is Lakehurst soils, 30 percent is Lakewood soils, 20 percent is Evesboro soils, and the remaining 10 percent is minor soils.

Lakehurst soils are moderately well drained or somewhat poorly drained. They have a water table that is moderately high in winter and low in summer. The Lakewood and Evesboro soils are excessively drained. Lakehurst and Lakewood soils have a bleached gray surface layer more than 7 inches thick. All major soils have sand to a depth of at least 40 inches. All are rapidly and moderately rapidly permeable and very low in natural fertility. The sands are loose and are subject to soil blowing.

The minor soils in this association are mostly the Downer, Woodmansie, and Atsion.

The soils of this association are poorly suited to crops. Nearly all areas are woodland, and much of the acreage is in pines. The trees are scrubby in areas that have been severely damaged by wildfire. Much of the association is in State forests or parks, where there is little likelihood of clearing the land for crops. In the forested areas large amounts of the rainfall are transmitted to the ground water. Pulpwood is periodically cut for sale, and in addition, the wooded area provides food and shelter for a large deerherd and for other animals.

This association is used extensively for camping and botanical study. Some sand and gravel pits are in the association, but the gravel is not abundant. Although pollution of shallow wells is a hazard, limitations to the use of these soils for septic tank disposal fields are moderate for Lakehurst and slight for Lakewood and Evesboro.

11. Woodmansie-Lakehurst association

Nearly level to gently sloping, well-drained to somewhat poorly drained soils that are rapidly and moderately rapidly permeable and have a sand to sandy loam subsoil

This association occupies extensive high areas on the outer Coastal Plain. It includes that part of the Pine Barrens called the Plains (*8*), an area where trees are dwarfed.

This association makes up about 8 percent of the county. About 50 percent of it is Woodmansie soils, 35

percent is Lakehurst soils, and the remaining 15 percent is minor soils.

The Woodmansie soils have a bleached sand surface layer and a dominantly sandy loam subsoil. They are well drained. Lakehurst soils also have a bleached surface horizon, but they are moderately well drained or somewhat poorly drained. They normally are downslope from Woodmansie soils. Their water table is moderately high in winter but drops considerably in summer. Both kinds of major soils are naturally infertile.

Few areas of this association have been cleared for crops. Nearly all areas are woodland, but forest production is low because damaging wildfires have been numerous.

A number of sand and gravel pits and a few clay pits are in this association, but the clay pits are no longer in use. Some of the gravel pits have been exhausted.

12. Atsion-Muck-Alluvial land, sandy, association

Nearly level, poorly drained soils that are moderately rapidly permeable and have a sand and loamy sand subsoil, and very poorly drained Muck and Alluvial land subject to frequent flooding from streams

This association occupies low positions that are in scattered areas of the outer Coastal Plain. It makes up about 20 percent of the county. About 50 percent is Atsion soils, 15 percent is Muck, shallow, 10 percent is Alluvial land, sandy, and the remaining 25 percent is minor soils.

All of the major soils in this association are wet and have a high water table. Muck and Alluvial land are subject to frequent flooding. The streamflow is mainly perennial, but flow in summer is small. Major flash floods from swollen streams do not occur, because much of the watershed consists of rapidly permeable, wooded soils. Pines grow on sandy soils; Atlantic white-cedar grows on Muck. Since streams have not cut deeply into the landscape, they sometimes flood adjacent Atsion and Berryland soils.

Minor soils in this association are mainly in the Berryland, Lakehurst, Fallsington, Pocomoke, and Klej series. They generally are sandy.

Blueberries and cranberries are grown extensively in this association. Both crops require a good supply of water (fig. 6). Blueberries need ground water held at a constant level in summer. Cranberries need water in fall for harvesting and in winter and spring for protection against frost. This association is not extensively cleared for any other crops.

A large part of this association is publicly owned in New Jersey Wharton State Forest, Lebanon State Forest, Bass River State Forest, and Fort Dix. Use of the soils for community development is severely limited by the hazard of flooding, the high water table, and the instability of Muck, shallow.

Figure 6.—Harvesting cranberries on the Atsion-Muck-Alluvial land, sandy, association.

13. Tidal Marsh association

Organic silts subject to daily flooding, along the Mullica and Wading Rivers

This association occupies the tidal flats along the Mullica and Wading Rivers in the southeastern part of the county. It makes up about 2 percent of the county.

This association consists mostly of Marsh, tidal, which is flooded twice daily. It is used extensively for hunting waterfowl. A cover of salt-tolerant grasses grows on this soil. It was formerly harvested as salt hay, but it is not harvested now. Few areas of the association are suitable as fresh-water impoundments for wildlife. The New Jersey Mosquito Commission has dug ditches extensively to reduce breeding areas of the mosquito. The Mullica and Wading Rivers have been dredged to provide a channel for small pleasure boats, and the dredged material was pumped into diked areas of Marsh, tidal.

Descriptions of the Soils

This section describes the soil series and mapping units in Burlington County. The approximate acreage and proportionate extent of each mapping unit are given in table 1.

The procedure in this section is first to describe the soil series and the mapping units in the series. Thus, to get full information on any one mapping unit, it is necessary to read the description of the unit and also the description of the soil series to which it belongs. The description of a soil series mentions features that apply to all the soils in the series. Differences among the soils of one series are pointed out in the descriptions of individual soils or are indicated in the soil name. Unless otherwise stated, the descriptions of all mapping units in this section are for moist soils. As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. For example, Alluvial land is a miscellaneous land type and does not belong to a soil series. It

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Adelphia fine sandy loam, 0 to 2 percent slopes	7,150	1.4
Adelphia fine sandy loam, 2 to 5 percent slopes	2,650	.5
Adelphia fine sandy loam, clayey substratum, 0 to 2 percent slopes	960	.2
Adelphia fine sandy loam, clayey substratum, 2 to 5 percent slopes	460	.1
Adelphia loam, 0 to 2 percent slopes	610	.1
Adelphia sandy clay loam, truncated	550	.1
Adelphia fine sandy loam, glauconitic variant, 0 to 2 percent slopes	2,140	.4
Adelphia fine sandy loam, glauconitic variant, 2 to 5 percent slopes	950	.2
Alluvial land, loamy	10,300	2.0
Alluvial land, sandy	13,100	2.5
Atsion sand	43,000	8.2
Atsion sand, loamy substratum	8,500	1.6
Atsion fine sand	12,400	2.4
Atsion fine sand, loamy substratum	680	.1
Berryland sand	1,600	.3
Berryland fine sand	1,800	.3
Berryland mucky sand	4,900	.9
Colemantown loam	4,600	.9
Collington fine sandy loam, 0 to 2 percent slopes	3,900	.7
Collington fine sandy loam, 2 to 5 percent slopes	7,000	1.3
Collington fine sandy loam, 5 to 10 percent slopes	1,300	.2
Collington loam, 0 to 2 percent slopes	300	.1
Collington loam, 2 to 5 percent slopes	350	.1
Donlonton fine sandy loam, 0 to 3 percent slopes	540	.1
Donlonton loam, 0 to 3 percent slopes	2,250	.4
Downer loamy sand, 0 to 2 percent slopes	10,900	2.1
Downer loamy sand, 2 to 5 percent slopes	6,100	1.2
Downer loamy sand, 5 to 10 percent slopes	850	.2
Downer loamy sand, gravelly substratum, 0 to 5 percent slopes	1,500	.3
Downer loamy sand, loamy substratum, 0 to 2 percent slopes	860	.2
Downer sandy loam, truncated, 0 to 5 percent slopes	200	([1])
Evesboro sand, 0 to 5 percent slopes	13,200	2.5
Evesboro sand, 5 to 10 percent slopes	640	.1
Evesboro sand, loamy substratum, 0 to 5 percent slopes	5,100	1.0
Evesboro fine sand, 0 to 5 percent slopes	7,600	1.5
Fallsington fine sandy loam	1,850	.4
Fallsington fine sandy loam, clayey substratum	800	.2
Freehold fine sandy loam, 0 to 2 percent slopes	5,850	1.1
Freehold fine sandy loam, 2 to 5 percent slopes	9,300	1.8
Freehold fine sandy loam, 5 to 10 percent slopes	1,850	.4
Freehold fine sandy loam, 10 to 15 percent slopes	1,300	.3
Freehold fine sandy loam, 15 to 25 percent slopes	580	.1
Freehold fine sandy loam, clayey substratum, 2 to 5 percent slopes	900	.2
Freehold loamy sand, 0 to 5 percent slopes	4,050	.8
Freehold loamy sand, 5 to 10 percent slopes	950	.2
Freehold sandy loam, 5 to 10 percent slopes, severely eroded	1,150	.2
Freehold sandy loam, 10 to 15 percent slopes, severely eroded	350	.1
Galestown sand, 0 to 5 percent slopes	13,000	2.5
Galestown sand, clayey substratum, 0 to 5 percent slopes	2,000	.4
Holmdel fine sandy loam, 0 to 2 percent slopes	8,700	1.7
Holmdel fine sandy loam, 2 to 5 percent slopes	3,050	.6
Holmdel loamy sand, 0 to 5 percent slopes	4,250	.8
Holmdel fine sandy loam, clayey substratum, 0 to 2 percent slopes	1,150	.2
Holmdel fine sandy loam, clayey substratum, 2 to 5 percent slopes	1,250	.2
Holmdel-Urban land complex	1,550	.3
Keansburg fine sandy loam	2,300	.4
Keyport loamy sand, 0 to 5 percent slopes	210	([1])
Keyport fine sandy loam, 2 to 5 percent slopes	680	.1
Keyport loam, 0 to 2 percent slopes	460	.1
Keyport loam, 2 to 5 percent slopes	1,500	.3
Keyport loam, 5 to 10 percent slopes	970	.2
Keyport loam, 10 to 15 percent slopes	950	.2
Keyport loam, 15 to 25 percent slopes	540	.1
Klej sand, 0 to 4 percent slopes	4,950	.9
Klej sand, loamy substratum, 0 to 2 percent slopes	440	.1
Klej fine sand, 0 to 2 percent slopes	3,650	.7
Kresson loamy sand, 0 to 3 percent slopes	620	.1
Kresson fine sandy loam, 0 to 3 percent slopes	2,300	.4
Kresson loam, 0 to 3 percent slopes	680	.1
Lakehurst sand, 0 to 3 percent slopes	34,800	6.6
Lakehurst sand, thick surface, 0 to 3 percent slopes	10,100	1.9
Lakehurst sand, loamy substratum, 0 to 3 percent slopes	6,400	1.2
Lakehurst fine sand, 0 to 3 percent slopes	8,500	1.6
Lakehurst fine sand, loamy substratum, 0 to 3 percent slopes	2,200	.4
Lakehurst-Lakewood sands, 0 to 5 percent slopes	5,550	1.1
Lakehurst-Lakewood sands, loamy substratum, 0 to 5 percent slopes	1,250	.2
Lakewood sand, 0 to 5 percent slopes	20,100	3.8
Lakewood sand, 5 to 10 percent slopes	2,400	.5
Lakewood sand, 10 to 15 percent slopes	350	.1
Lakewood sand, thick surface, 0 to 5 percent slopes	2,650	.5
Lakewood sand, loamy substratum, 0 to 5 percent slopes	10,100	1.9
Lakewood fine sand, 0 to 5 percent slopes	4,100	.8
Lakewood fine sand, loamy substratum, 0 to 5 percent slopes	1,250	.2
Made land, dredged coarse material	1,700	.3
Made land, dredged fine material	370	.1
Made land, sanitary fill	730	.1
Marlton fine sandy loam, 0 to 2 percent slopes	420	.1
Marlton fine sandy loam, 2 to 5 percent slopes	1,750	.3
Marlton soils, 5 to 10 percent slopes	200	([1])
Marsh, fresh water	280	.1
Marsh, tidal	9,500	1.8
Muck, shallow	16,600	3.2
Nixonton fine sandy loam, 0 to 2 percent slopes	3,150	.6
Nixonton fine sandy loam, 2 to 5 percent slopes	620	.1
Nixonton loamy fine sand, 0 to 2 percent slopes	2,450	.5
Nixonton loamy fine sand, 2 to 5 percent slopes	460	.1
Pasquotank fine sandy loam	4,100	.8
Pemberton sand, 0 to 5 percent slopes	5,250	1.0
Pemberton sand, thick surface, 0 to 5 percent slopes	1,400	.3
Pits, sand and gravel	2,400	.5

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Acres	Percent
Pits, clay and marl	500	.1
Pocomoke fine sandy loam	6,600	1.3
Sandy land, ironstone	310	.1
Sassafras loamy sand, 0 to 5 percent slopes	2,300	.4
Sassafras fine sandy loam, 0 to 2 percent slopes	4,450	.8
Sassafras fine sandy loam, 2 to 5 percent slopes	4,750	.9
Sassafras fine sandy loam, 5 to 10 percent slopes	810	.2
Sassafras fine sandy loam, clayey substratum, 0 to 2 percent slopes	840	.2
Sassafras fine sandy loam, clayey substratum, 2 to 5 percent slopes	2,300	.4
Sassafras-Urban land complex	1,050	.2
Sassafras-Urban land complex, clayey substrata	740	.1
Shrewsbury fine sandy loam	7,000	1.3
Shrewsbury fine sandy loam, clayey substratum	1,200	.2
Shrewsbury loam	890	.2
Shrewsbury sandy clay loam, truncated	190	([1])
Shrewsbury fine sandy loam, ironstone variant	980	.2
Tinton sand, 0 to 5 percent slopes	2,500	.5
Tinton sand, 5 to 10 percent slopes	360	.1
Tinton sand, thick surface, 0 to 5 percent slopes	3,850	.7
Urban land, sandy	11,900	2.3
Urban land, clayey	650	.1
Urban land, sandy over clayey	2,450	.5
Westphalia loamy fine sand, 0 to 2 percent slopes	410	.1
Westphalia loamy fine sand, 2 to 5 percent slopes	760	.1
Westphalia fine sandy loam, 0 to 2 percent slopes	620	.1
Westphalia fine sandy loam, 2 to 5 percent slopes	1,400	.3
Woodmansie sand, 0 to 5 percent slopes	15,300	2.9
Woodmansie sand, 5 to 10 percent slopes	1,150	.2
Woodmansie sand, firm substratum, 2 to 5 percent slopes	1,600	.3
Woodmansie sand, loamy substratum, 0 to 5 percent slopes	4,400	.8
Woodstown loamy sand, 0 to 2 percent slopes	4,300	.8
Woodstown loamy sand, loamy substratum, 0 to 2 percent slopes	1,750	.3
Woodstown fine sandy loam, 0 to 2 percent slopes	4,700	.9
Woodstown fine sandy loam, 2 to 5 percent slopes	1,050	.2
Woodstown fine sandy loam, clayey substratum, 0 to 2 percent slopes	3,100	.6
Woodstown fine sandy loam, clayey substratum, 2 to 5 percent slopes	2,800	.5
Total	[2] 524,160	100.0

[1] Less than 0.1 percent.
[2] Mapping unit acreages have been adjusted to the official county land acreage of 524,160, but acreage of land and water changes continually. Extensive acreage of Made land along the Delaware River has been made of what was recently river or tidal marsh. At the same time, at Dredge Harbor and Burlington Island, the river is enlarged by dredging into the land.

is, nevertheless, listed in alphabetic order along with the series.

An essential part of each soil series is the description of the soil profile, the sequence of layers beginning at the surface and continuing downward to the depth beyond which roots of most plants do not penetrate. Each soil series contains a short description of the same profile that scientists, engineers, and others can use in making highly technical interpretations.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and woodland suitability group in which the mapping unit has been placed.

In this survey the management of soils by groups called capability units is not discussed, but the system of capability classification is explained in the section "Use and Management of Soils." In the section "Descriptions of the Soils," each mapping unit suitable for cultivation contains suggestions on how the mapping unit can be managed. A table in the subsection "Use of Soils as Commercial Woodland" groups the soils of the county in woodland suitability groups and gives information helpful in managing the soils for trees.

Many terms used in the soil descriptions and other sections of this survey are defined in the Glossary at the back of this soil survey and in the "Soil Survey Manual" (*24*).

Adelphia Series

The Adelphia series consists of loamy soils that contain moderate amounts of glauconite. These soils have a fluctuating water table and are moderately well drained and somewhat poorly drained. They are nearly level or gently sloping.

In a typical profile the surface layer is dark grayish-brown fine sandy loam about 10 inches thick. The subsurface layer, about 4 inches thick, is light olive-brown fine sandy loam. The subsoil is olive-brown, distinctly mottled sandy clay loam about 16 inches thick. It is underlain by alternating layers of olive-gray, dark-olive, and yellowish-brown loamy sand and sandy loam.

Adelphia soils are mostly associated with the Collington, Shrewsbury, Keansburg, Holmdel, and Pemberton soils. Adelphia soils are below Collington soils, are above Shrewsbury and Keansburg soils, and are in about the same intermediate positions as are the Holmdel and Pemberton soils.

Although Adelphia soils are moderately well drained and somewhat poorly drained, in this county they are moderately well drained in most places. In undisturbed areas when rainfall is normal, the water table generally begins to rise in October and reaches its peak of about 2 feet from the surface in December. It fluctuates near this peak until April, when it starts to drop. From July to October the water table is below a depth of 5 feet.

Adelphia soils have moderately slow to moderate permeability and are drained readily by open ditches or underdrains. Surface drainage also is needed in some areas. These soils have high or moderately high available water capacity. Organic-matter content is moderate, and the natural fertility is moderately high. Added fertilizers do not leach readily. In unlimed areas Adelphia soils are very strongly acid.

The native vegetation on Adelphia soils is a hardwood forest that consists mostly of red oak, white oak, scarlet oak, black oak, hickory, beech, ash, yellow-poplar, and sweetgum. In the lower areas pin and willow oaks are also common. Sweetgum invades idle fields and may occupy a site for many years before other hardwoods become established.

About 80 to 90 percent of the acreage of Adelphia soils has been cleared and drained for crops. In many areas, however, drainage is not deep enough to permit the use of modern farm machines. Better drainage is needed for high-value crops than for general crops. The crops grown on Adelphia soils include small grains, corn, soybeans, hay, and pasture, which are general crops, and tomatoes, potatoes, fruit, nursery stock, and sod, which are high-value crops.

Typical profile of Adelphia fine sandy loam, 0 to 2 percent slopes, in a cultivated field 1 mile northwest of Jacobstown:

Ap—0 to 10 inches, dark grayish-brown (2.5Y 4/2) fine sandy loam; weak, fine, granular structure; friable; glauconite content low; abrupt, smooth boundary; horizon 8 to 12 inches thick.

A2—10 to 14 inches, light olive-brown (2.5Y 5/6) fine sandy loam; very weak, fine, granular structure; very friable; glauconite content low; gradual, smooth boundary; horizon 0 to 6 inches thick.

Bt—14 to 30 inches, olive-brown (2.5Y 4/4) sandy clay loam; few, medium, distinct mottles of olive gray (5Y 5/2) and yellowish brown (10YR 5/8) that increase in number with depth; weak, medium, subangular blocky structure; friable when moist, hard when dry, sticky and plastic when wet; pores common; sand grains bridged; glauconite content moderate; mica common; clear, smooth boundary; horizon 10 to 30 inches thick.

C—30 to 60 inches, alternating layers of olive-gray (5Y 4/2) and dark-olive (5Y 3/3) and yellowish-brown (10YR 5/8) loamy sand and sandy loam; brownish layers mottled with gray; loamy sand is single grain and loose; sandy loam is massive and friable; glauconite content moderate.

Adelphia soils contain varying amounts of rounded pieces of quartzose gravel. Although this gravel is not abundant, it is most common in the C horizon. Unplowed areas of Adelphia soils have a very dark A1 horizon that is normally about 4 inches thick. Where these soils are plowed, this horizon is destroyed and mixed with some of the A2 horizon to make up the Ap horizon. The Ap horizon is 3 or 4 in value. The A2 horizon is absent in some places.

The B horizon ranges from heavy fine sandy loam to fine sandy clay loam. It contains many red or reddish-brown iron concretions in many places. In some places iron-cemented layers have formed at the line of contact between the B horizon and the C horizon. These layers range from ½ inch to 6 inches or more in thickness, and they are very firm in places. The thinner B horizons commonly are in low position where iron concretions and iron-cemented layers are abundant. Mottles in the B horizon range from few to many and from distinct to prominent. They range from 5Y to 5YR in hue and from 2 to 8 in chroma.

Mottling in the Adelphia soils distinguishes them from Collington soils. Adelphia soils are not so gray as the Shrewsbury and Keansburg soils. They contain more glauconite and are more olive colored than the Holmdel soils, and they have a thinner and finer textured surface layer than the Pemberton soils.

Adelphia fine sandy loam, 0 to 2 percent slopes (AaA).—This soil has the profile described as typical for the series. Included with this soil in mapping are small areas of other Adelphia soils and of Shrewsbury, Collington, and Holmdel soils.

Subsurface drainage is needed to make this soil suited to crops. Some areas, particularly where high-value crops are grown, need surface drainage as well. (Capability unit IIw–14; woodland suitability group 2w1)

Adelphia fine sandy loam, 2 to 5 percent slopes (AaB).—The profile of this soil is similar to that described as typical for the series. Included with this soil in mapping are Collington, Holmdel, and other Adelphia soils.

Use of this soil is limited by drainage and by susceptibility to erosion. Interceptor underdrains are effective in improving drainage in many places. Contour farming may help in reducing the erosion hazard on long slopes. (Capability unit IIw–14; woodland suitability group 2w1)

Adelphia fine sandy loam, clayey substratum, 0 to 2 percent slopes (AcA).—This soil has a clayey substratum, but otherwise its profile is similar to that described as typical for the series. The substratum normally is at a depth of 40 to 60 inches but, in some places, it is only 30 inches below the surface.

This soil is similar to Adelphia fine sandy loam, 0 to 2 percent slopes, in use and management for crops. Underdrains normally should be installed on or above the clayey layers. Ponds dug in this soil recharge slowly, and some of them are extremely acid. (Capability unit IIw–14; woodland suitability group 2w1)

Adelphia fine sandy loam, clayey substratum, 2 to 5 percent slopes (AcB).—This soil has a clayey substratum, but otherwise its profile is similar to that described as typical for the series. This clayey layer normally lies 40 to 60 inches below the surface.

Use of this soil is limited by drainage and by susceptibility to erosion. Drainage can be improved by installing underdrains, normally on or above the clayey layers. Contour farming reduces the hazard of erosion on long slopes. (Capability unit IIw–14; woodland suitability group 2w1)

Adelphia loam, 0 to 2 percent slopes (AhA).—Except for its loam surface layer, the profile of this soil is similar to that described as typical for the series. This soil warms more slowly in spring than Adelphia fine sandy loam, 0 to 2 percent slopes, and it cannot be worked so soon after rains. Also, it has a higher available water capacity, is subject to more severe frost heave, and is not so well suited to vegetables that require much working of the soil. (Capability unit IIw–13; woodland suitability group 2w1)

Adelphia sandy clay loam, truncated (Ak).—This soil has slopes of as much as 5 percent. Its profile is similar to the part of a typical profile that is left after 1 foot of material has been removed for use as topsoil. The sur-

face layer of this truncated soil is low in organic-matter content and contains more clay than the original surface layer. Runoff and erosion are moderate. Most of this soil is within the Fort Dix Military Reservation.

This soil normally is seeded with a mixture of perennial plants that provide food or cover for wildlife. These plants add organic matter to the soil. (Capability unit IIw–13; woodland suitability group 2w1)

Adelphia Fine Sandy Loam, Glauconitic Variants

These soils are moderately high in content of glauconite throughout the profile. Also, they have a subsoil slightly finer textured and nearer the surface than in the profile described as typical for the Adelphia series.

In a typical profile of a glauconitic variant, the surface layer is a very dark grayish-brown fine sandy loam about 10 inches thick. The subsoil is a light olive-brown heavy sandy clay loam that extends to a depth of about 28 inches and is mottled with olive gray in the lower part. The underlying material is dark-olive stratified sandy loam containing thin iron-cemented sheets. Although the surface layer and subsoil are moderately high in glauconite, the texture of these layers is more like that in corresponding layers of other Adelphia soils than like that in Kresson or Marlton soils.

Natural drainage of the glauconitic variants is similar to that of normal Adelphia soils, but permeability of the subsoil is slower. Also, the available water capacity is higher and natural fertility is slightly higher.

These soils are similar to normal Adelphia soils in natural vegetation and in use for farming.

Typical profile of Adelphia fine sandy loam, glauconitic variant, 0 to 2 percent slopes, 0.8 mile northwest of Tilghmans Corner:

Ap—0 to 10 inches, very dark grayish-brown (2.5Y 3/2) fine sandy loam; moderate, medium, granular structure; friable; glauconite content moderately high; abrupt, smooth boundary; horizon 8 to 12 inches thick.

B2—10 to 18 inches, light olive-brown (2.5Y 5/4) heavy sandy clay loam; weak, medium, subangular blocky structure; very friable when moist, slightly sticky and plastic when wet; sand grains bridged with clay; glauconite content moderately high; gradual, smooth boundary; horizon 6 to 12 inches thick.

B3—18 to 28 inches, light olive-brown (2.5Y 5/4) heavy sandy clay loam; common, medium, distinct mottles of olive gray (5Y 5/2); weak, medium, subangular blocky structure; very friable when moist, slightly sticky when wet; sand grains bridged; yellowish-red (5YR 4/6) iron concretions as much as one-half inch in diameter; glauconite content moderately high; gradual, smooth boundary; horizon 6 to 15 inches thick.

C—28 to 60 inches, dark-olive (5Y 3/3) sandy loam stratified with reddish-brown (5YR 4/3), iron-cemented layers 1 to 2 inches thick.

These soils have a darker A horizon than the normal Adelphia soils. They lack the A2 horizon that commonly occurs in the normal Adelphia soils. The B horizon is slightly finer textured than that in the profile described as typical for the Adelphia series. The glauconitic variants, however, are similar to the normal Adelphia soils in consistence and in color, or they are more olive.

The C horizon of the glauconitic variant is darker colored than that in normal Adelphia soils. The iron-cemented layers generally are between depths of 36 and 60 inches, but they are closer than 36 inches from the surface in sloping areas. The layers range from ½ inch to 6 inches or more in thickness and from firm to extremely firm in consistence. Because these layers are very slowly permeable, deep drainage is difficult to obtain.

The glauconitic variants are mostly associated with other Adelphia soils and with Collington, Marlton, Kresson, and Shrewsbury soils. Mottling in these variants distinguishes them from the Collington soils. The variants do not contain so much clay in the subsoil as do the Marlton and Kresson soils, and they are not so gray as the Shrewsbury soils.

Adelphia fine sandy loam, glauconitic variant, 0 to 2 percent slopes (AnA).—This soil has the profile described as typical for the Adelphia glauconitic variant. Included with this soil in mapping are small areas of other Adelphia soils and of Kresson, Marlton, and Collington soils.

This soil warms somewhat late in spring, and it dries slowly after heavy rains. Drainage needs are similar to those of Adelphia fine sandy loam, 0 to 2 percent slopes, and the same kinds of crops are grown. (Capability unit IIw–14; woodland suitability group 2w1)

Adelphia fine sandy loam, glauconitic variant, 2 to 5 percent slopes (AnB).—Runoff is more rapid on this soil than on Adelphia fine sandy loam, glauconitic variant, 0 to 2 percent slopes, and the hazard of erosion is greater. Interceptor underdrains may be effective in removing some of the excess water from this soil. (Capability unit IIw–14; woodland suitability group 2w1)

Alluvial Land

Alluvial land consists of areas where the soil materials are so variable that mapping units cannot be placed in a series. Instead, the areas are described as Alluvial land, loamy, and Alluvial land, sandy.

Alluvial land, loamy (Ao).—This land type consists of stream deposits adjacent to meandering perennial streams that are subject to stream overflow. Most areas flood annually or several times a year, but a small portion is high enough to escape the annual overflow. Along the main branches of the Rancocas Creek, where the streams have cut deeply, the floodwaters are confined by steep side slopes. But some streams, such as Barkers Creek, are not confined and overflow the nearby upland soils. The native vegetation is fast-growing hardwoods consisting of yellow-poplar, red oak, pin oak, white oak, willow oak, sweetgum, ash, red maple, beech, boxelder, elm, and river birch.

Soil textures vary considerably according to the position of this land and the source of material. Although the surface layer is sandy loam in most places, there are areas where the sand components are dominantly fine or where the texture may be as fine as clay loam. In some places the soil is underlain by olive-colored beds of sandy clay. Included with this land in mapping are small areas of Muck.

The soil material ranges from black to gray to olive to reddish brown. It is prominently mottled in some

places but is not mottled in others. Cemented iron is in forms ranging from small spherical concretions to 6-inch layers of ironstone. Although most areas have moderate to low glauconite content, glauconite is absent in some places and is in large amounts in other places. In most places the soil materials are extremely acid, but in some areas where the streams have cut through the Vincentown Formation into the underlying limy sand, the soil materials and water are nearly neutral.

Alluvial land, loamy, is moderately well drained to very poorly drained. Most of it is in low areas and is subject to frequent flooding. In these low areas, the water table is at the surface in winter and drops only about a foot in summer. Some areas are flooded only occasionally because they are several feet higher than the lowest areas. In these higher areas the water table is 2 or 3 feet from the surface in winter and drops about a foot in summer.

Some of these higher areas have been cleared for crops, though they are small and in places are surrounded by low areas. At Ewansville and Lumberton on the North and South Branches of the Rancocas Creek, numerous houses have been built on these higher areas, though they are subject to flooding. The last major damaging flood was in 1940. At Mount Holly, however, the channel has been widened, deepened, and straightened to provide some flood protection below Ironworks Park Dam. (Capability unit VIw–28; woodland suitability group 1w1)

Alluvial land, sandy (Ap).—This land consists mainly of thick deposits of loose, coarse sand and gravel adjacent to the larger meandering perennial streams in the outer Coastal Plain. Most of the land is subject to annual flooding, and about 5 to 10 percent of the area is subject to flooding every 5 to 10 years. Except for a dark surface layer, the soil material has few well-developed horizon features.

This land is nearly level to gently sloping. The soil material is black, dark brown, or very dark gray. In some places it is mucky to a depth of a foot or more. The underlying sand is grayish brown and contains a considerable amount of rounded quartzose pebbles in places. Because the streams are shallow in most places, floodwaters spread rapidly to the adjacent soils, where they deposit much debris.

Alluvial land, sandy, is mostly associated with Atsion and Berryland soils and with Muck, and they are included in mapped areas. Also included are sandy soils that do not have an organic subsoil.

This land has a constantly high water table that is controlled by the adjacent stream. This water table is at the surface in winter and, except during extreme drought, it drops only about a foot in summer. The soil material is rapidly permeable, low in fertility, and extremely acid. Where this land is drained, the available water capacity is low in the sandy areas but is high in the mucky areas. Frost heave is slight on the sand and severe in mucky areas.

The native vegetation varies. Atlantic white-cedar grows in the mucky areas, and pitch pine, red maple, blackgum, gray birch, and bay magnolia grow in the sandy areas.

Some of this land has been cleared and planted to cranberries or blueberries. Water is impounded in some areas. This land is suitable for dug ponds, but there is an overflow hazard. (Capability unit VIw–28; woodland suitability group 3w1)

Atsion Series

The Atsion series consists of poorly drained, dark-gray sandy soils that formed on the borders of swamp and the bottoms of some circular depressions in the outer Coastal Plain. These soils are also on extensive terraces adjacent to the Mullica, Batsto, and Wading Rivers. The terraces contain numerous narrow and intermittent streambeds. Since these soils are nearly level and in low positions, they receive runoff from the slopes above.

A typical profile has a dark-gray sand plow layer about 8 inches thick. The subsurface layer, about 10 inches thick, is light-gray sand. The subsoil extends to a depth of about 36 inches and is weakly to strongly cemented, very dark brown loamy sand in the upper 6 inches and very dark gray sand below. The substratum is brown loose sand.

Because of the high water table, Atsion soils warm late in spring. Where drained, they have a low available water capacity. When the water table is low enough to permit percolation, permeability is moderately rapid. These soils have moderate organic-matter content and low fertility. Added fertilizers leach readily. Since few areas have been limed, Atsion soils are very strongly acid in most places.

When rainfall is normal, Atsion soils are saturated 6 to 8 months of the year. The water table starts to rise in October, reaches its peak of about 1 foot from the surface, and drops to about 2 feet below the surface by the end of May. In some areas drained for blueberries, the water level is 3 feet below the surface in summer. In extremely dry summers, some drained areas have a water table below 5 feet.

Native vegetation on Atsion soils is a stand of pitch pine and scattered scrub oak trees and a dense understory of highbush blueberry, sheep laurel, sweet pepperbush, gallberry, and greenbrier.

Where they are drained, these soils are suited to highbush blueberries and cranberries. Blueberries are grown more extensively on Atsion soils than on any other kind of soil in Burlington County.

In the management of Atsion soils for blueberries, the water level in summer is controlled at about 2 feet below the surface by subsurface irrigation and the use of ditches. Also, the cropland is smoothed to prevent surface ponding and to prepare the fields for the heavy over-the-row harvesters.

Atsion soils are generally good sites for dug ponds, but recharge may be slow in some areas where the substratum is loamy.

Typical profile of Atsion sand in a blueberry field that is 2.8 miles south of Speedwell and adjacent to County Highway 563:

Ap—0 to 8 inches, dark-gray (10YR 4/1) sand, gray (10YR 5/1) when dry; single grain; loose; abrupt, wavy boundary; horizon 6 to 10 inches thick.

A2—8 to 18 inches, light-gray (10YR 6/1) sand, light-gray (10YR 7/1) when dry; single grain; loose; abrupt, wavy boundary; horizon 5 to 18 inches thick.
B2h—18 to 24 inches, very dark brown (7.5YR 2/2) loamy sand, dark grayish brown (10YR 4/2) when dry, single grain and massive; loose and discontinuous, weakly to strongly cemented; diffuse, wavy boundary; horizon 4 to 8 inches thick.
B3—24 to 36 inches, very dark gray (10YR 3/1) sand, grayish brown (10YR 5/2) when dry; single grain; loose; about 5 percent is rounded quartzose pebbles as much as 2 inches in diameter; gradual, wavy boundary; horizon 0 to 18 inches thick.
C—36 to 60 inches, brown (10YR 5/3) sand, grayish brown (10YR 5/2) when dry; single grain; loose; about 5 percent is rounded quartzose pebbles.

In unplowed areas, the A1 horizon of Atsion soils ranges from 2.5Y to 10YR in hue, is 3 or 4 in value, and is 0 to 1 in chroma. Average thickness is 5 inches. The A2 horizon ranges from 2.5Y to 5YR in hue, from 5 to 7 in value, and is 1 or 2 in chroma.

The B2h horizon ranges from 10YR to 5YR in hue, is 2 or 3 in value, and is 1 or 2 in chroma. This horizon ranges from loose to very firm in consistence. Cementation is caused by organic matter. The B3 horizon is absent in some places, but where present, it ranges from 3 to 5 in value and from 1 to 4 in chroma.

The C horizon is 2.5Y or 10YR in hue, is 5 or 6 in value, and ranges from 1 to 8 in chroma. In places the substratum has numerous B2h layers, which are probably layers of buried soils. In some areas, the substratum is loamy. Where these areas are extensive, the soil is mapped as Atsion sand, loamy substratum.

Atsion soils have varying amounts of rounded quartzose pebbles, especially in the C horizon and especially where the soils are on river terraces.

Atsion soils are associated with Berryland and Lakehurst soils and with Muck, shallow, and Alluvial land, sandy. Atsion soils lack the very dark surface layer common to Berryland soils. They have a darker surface layer and a more gray lower subsoil than the Lakehurst soils. Atsion soils lack the black organic surface layer that commonly occurs in Muck, and they have a dark-brown partly cemented B horizon.

In Camden and Gloucester Counties the Atsion soils were called Leon. They were renamed to distinguish them from the Leon soils of the southern States, where they react differently because of the warmer climate.

Atsion sand (At).—This soil is nearly level, and some areas are flooded by adjacent streams when rainfall is abnormally heavy. The profile of this soil is the one described as typical for the series.

Included with this soil in mapping are small areas of loamy sand or fine sand and of soils having a loamy substratum. Also included are small areas of Berryland and Lakehurst soils. Atsion sand generally is associated with the Berryland and Lakehurst soils. It is in an intermediate position higher than that of the Berryland soils but lower than that of the Lakehurst soils.

About 10 percent of Atsion sand has been cleared for blueberries or cranberries. Most of the remaining acreage is in forest.

Where this soil is used for blueberries, a combination of ditches and underdrains normally is used to lower and control the water level. When planning draining and land grading, particularly where there are inclusions of Muck or Berryland mucky sand, care should be taken to allow for normal settling of the soil and to prevent ditches from clogging (fig. 7). Protection from wildfires is needed in wooded areas. (Capability unit Vw–22; woodland suitability group 3w1)

Figure 7.—Loose sands clog the ditches where surface runoff is permitted to overflow the banks. Blueberry field on Atsion sand.

Atsion sand, loamy substratum (Au).—This soil has underlying layers, normally below a depth of 40 inches, that are finer textured than the layers above them. In most places these underlying layers are sandy clay loam, but in some places they include heavy sandy loam, sandy clay, or clay. Except for the underlying layers, this soil has a profile similar to the one described as typical for the series. The water table in this soil fluctuates more rapidly than that in Atsion sand.

Included with Atsion sand, loamy substratum, in mapping are some areas that have a loamy sand or fine sand surface layer.

This soil is mostly woodland, which needs protection from wildfires. Sites are suitable for dug ponds, though the recharge rate is somewhat slower than for ponds dug in Atsion sand. For blueberries, management is about the same on Atsion sand, loamy substratum, as that described for Atsion sand. (Capability unit Vw–22; woodland suitability group 3w1)

Atsion fine sand (Av).—This soil is fine sand to a depth of 2 to 3 feet, but otherwise it has a profile similar to that described as typical for the series. Included with this soil in mapping are small areas of Pasquotank and Pocomoke soils.

This soil has a slightly higher available water capacity than Atsion sand. Drainage on Atsion fine sand is difficult. When saturated, the fine sand flows so severely that banks of ditches dug in it collapse. Maintenance of ditchbanks is costly, and in places ditches must be redug frequently. Most areas of this soil are used as woodland and need protection from wildfires. (Capability unit Vw–22; woodland suitability group 3w1)

Atsion fine sand, loamy substratum (Aw).—This soil has finer textured underlying layers than the layers above them. The underlying layers normally are at a depth of 40 to 60 inches, but in some places they are only 30 inches from the surface. These layers gener-

ally are sandy clay loam, but in places they are sandy loam, sandy clay, or clay. In most places these layers are not thick, but in some places ponds dug to a depth of 15 feet did not penetrate them. Except for these underlying layers and the fine sand surface layer, this soil has a profile similar to the one described as typical for the series. Permeability is slower and the water table fluctuates more rapidly in this soil than in Atsion sand.

Most of Atsion fine sand, loamy substratum, is woodland, which needs protection from wildfires. This soil is used and managed in about the same way as Atsion fine sand. Ditch construction and maintenance are difficult. (Capability unit Vw–22; woodland suitability group 3w1)

Berryland Series

The Berryland series consists of saturated sands that have a very dark surface layer over a dark subsoil. The subsoil ranges from loose to very firmly cemented, and the substratum is sandy. Berryland soils are very poorly drained because they are in nearly level areas such as marsh borders, swamp borders, or the bottoms of circular depressions.

In a typical profile the surface layer is black sand about 10 inches thick. The subsurface layer, about 6 inches thick, is gray sand. The subsoil is dark reddish-brown loamy sand about 8 inches thick. The substratum is grayish-brown sand.

In the very poorly drained Berryland soils, the water table does not drop below 2 feet in summer when rainfall is normal, and it is at the surface from November through May. Unless the surface layer is mucky or the underlying layers are clay, Berryland soils have moderately rapid permeability. Permeability of the subsoil is variable. This horizon is loose and rapidly permeable in many places, but the loose and rapidly permeable material is interspersed with firm material that makes the soil similar to a sieve. Where the subsoil is firm, permeability is slowed. The water level, however, is held high by a deeper layer, which in most places is clayey. Either open ditches or underdrains can be used to lower the water table.

Because the subsoil varies in consistence, Berryland soils can be drained readily but not uniformly. Where they are drained, these soils have a low available water capacity. Where the content of sand is low, as in Berryland mucky sand, there is settling. These soils have varying amounts of quartzose gravel. This gravel is most abundant in the underlying layers where the soils are on river or stream terraces. The organic-matter content of Berryland soils is high. Natural fertility is low, and the soils are very strongly acid.

The native vegetation on Berryland soils is a forest consisting of mostly pitch pine and of some scattered Atlantic white-cedar, blackgum, red maple, and sweetbay. Normally, there is a dense understory of sweet pepperbush, highbush blueberry, gallberry, and leatherleaf.

Less than 10 percent of the acreage of Berryland soils has been cleared for farming. This is because much of the soil is in public ownership as State forest,

Figure 8.—**Planting on a newly constructed cranberry bog on sandy Berryland soil.**

or is in such low positions that drainage is difficult to install and maintain. Cleared areas are used primarily for blueberries and cranberries (fig. 8). Between 1850 and 1920 most areas were originally cleared for cranberries, and they were used for that purpose until about 1930, when much of the area was planted to blueberries. This trend was reversed around 1965, when the change to water-harvesting cranberries caused a revival of interest in improving cranberry bogs or in building new ones.

Berryland soils are excellent sites for dug ponds, but the recharge rate may be slow where the soils are underlain by thick clay beds.

Typical profile of Berryland sand in a blueberry field, 1 mile east of the place where County Highway 563 crosses the West Branch of Wading River about 6 miles south of Chatsworth:

Ap—0 to 10 inches, black (10YR 2/1) sand that has bleached white grains scattered over the surface; very weak, fine, granular structure; very friable; very strongly acid; abrupt, smooth boundary; horizon 8 to 12 inches thick.

A2—10 to 16 inches, gray (10YR 6/1) sand; single grain; loose; very strongly acid; abrupt, wavy to irregular boundary; horizon 0 to 8 inches thick.

Bh—16 to 24 inches, dark reddish-brown (5YR 3/2) loamy sand; massive, friable to firm; very strongly acid; gradual, wavy boundary; horizon 4 to 12 inches thick.

C—24 to 60 inches, grayish-brown (10YR 5/2) sand; single grain; loose; rounded quartzose gravel as much as 2 inches in diameter make up 10 percent of horizon; very strongly acid.

The A1 horizon is sand, fine sand, or mucky sand and normally is about 10 inches thick. It is 2 or 3 in value and 1 or 2 in chroma. The A2 horizon is absent in many places; where it occurs, it is 5 or 6 in value.

The Bh horizon generally is loamy sand or sand that ranges from 4 to 12 inches in thickness but has an average thickness of about 8 inches. It ranges from 10YR to 5YR in hue, is 2 or 3 in value, and generally is 2 in chroma. Consistence ranges from loose to very firm within a few feet and becomes harder when the soil dries. In most places cementation is caused by organic matter, but iron-cemented sandstone also forms in places.

A loose C horizon occurs in places and is not so dark as the solum. It ranges from 4 to 6 in value and from 1 to 6 in

chroma. In places the C horizon has numerous layers that resemble the Bh horizon above. These layers appear to be subsoil material that formed when the water levels were lower. In places the C horizon has a strong hydrogen sulfide odor. Some areas are underlain by clayey layers, normally at depths below 50 inches.

Berryland soils occur most extensively just above the tidal marshes in soil association 12, where drainage is slowed by the rise in stream level caused by the tides. They are associated with Atsion, Muck, Alluvial land, sandy, and Marsh, tidal. They normally occur above Muck and Alluvial land, sandy, and below Atsion soils.

Berryland soils have a darker and thicker A1 horizon than Atsion soils. They lack the organic layer that is commonly at a depth of more than 12 inches in Muck. They have a prominent dark Bh horizon that generally is absent in Alluvial land, sandy. Berryland soils lack the thick organic silts that are commonly in Marsh, tidal.

In Camden and Gloucester Counties these Berryland soils were called St. Johns. They were renamed to distinguish them from St. Johns soils of the southern States, where they react differently because of the warmer climate.

Berryland sand (Bp).—This nearly level soil has the profile described as typical for the series. Included with this soil in mapping are areas that were cleared for cranberries and blueberries and that were disturbed somewhat by leveling and the construction of ditches, dikes, and dams. Some cranberry bogs have been sanded. Also included are Atsion soils and other Berryland soils. Some areas just above the tidal flats lack the typical dark-colored layer in the subsoil or have a sandy loam subsoil.

Where used for cranberries or blueberries, this soil must be drained. Both crops benefit from controlled water levels and closely graded slopes that permit a minimum of surface ponding. Cranberries need reservoirs and a canal system for water distribution. Blueberries need gates or boxes for controlling the water level. (Capability unit Vw–26; woodland suitability group 3w1)

Berryland fine sand (Bt).—Except that it has a fine sand surface layer that extends to a depth of at least 30 inches in most places, the profile of this soil is similar to that described as typical for the series. This soil is more slowly permeable than Berryland sand. Where it is ditched, the saturated fine sand flows more rapidly than sand, and maintenance of ditchbanks is more difficult and costly.

Included with this soil in mapping are areas of Atsion soils and of other Berryland soils. Also included are some areas where the soil has been disturbed by development for cranberry and blueberry production.

Where it is drained and leveled, and a water-level control system is added, this soil is well suited to cranberries and blueberries. (Capability unit Vw–26; woodland suitability group 3w1)

Berryland mucky sand (Bu).—Except that it has a high percentage of finely divided organic matter (muck) in the upper 6 to 12 inches, the profile of this soil is similar to that described as typical for the series. Where it is cleared and drained for cranberries or blueberries, this soil is subject to moderate subsidence. It has a higher available water capacity and natural fertility than Berryland sand.

Included with this soil in mapping are Atsion soils and other Berryland soils. Also included are areas where the soils have been altered considerably by the development of cranberry or blueberry fields.

Where there is no hazard of subsidence, this soil is better suited to cranberries and blueberries than is Berryland sand.

Draining and grading Berryland mucky sand for blueberries or cranberries is difficult because of the subsidence. Regrading and replanting may be needed in the worst areas. Many areas are so low that drainage is expensive and difficult. (Capability unit Vw–26; woodland suitability group 3w1)

Colemantown Series

The Colemantown series consists of poorly drained, dark-olive or dark greenish-gray soils that are prominently mottled. The subsoil is highly glauconitic. Because the soils are nearly level and are in low positions, they receive much water as runoff and as underground seepage from the slopes above. In places they occupy headwaters of streams protected from flooding by deep ditches. Because the soils are nearly level, many separate properties may have to be crossed by ditches before they fall enough to be effective.

In a typical profile the surface layer, about 10 inches thick, is greenish-gray mottled loam. The subsoil, which extends to a depth of 34 inches, is dark greenish-gray mottled sandy clay loam in the upper 6 inches, dark greenish-gray sandy clay in the middle, and dark-olive clay loam below a depth of 24 inches. The underlying material is alternating layers of dark-olive mottled clay loam and sandy loam.

In their natural condition, Colemantown soils contain free water 8 to 10 months of the year. The surface layer is ponded; the substratum is saturated, but the subsoil does not become saturated. The subsoil is so slowly permeable that, in places, water occurs both above and below it. Where the water below the subsoil is under pressure, it rises when the subsoil is punc-

Figure 9.—Land smoothing is effective in removing the perched surface water on Colemantown loam.

tured. This happens when building excavations reach the substratum.

These soils need surface and substratum drainage if they are to be farmed (fig. 9). Although underdrains work too slowly to be of much benefit to the surface layer, either underdrains or open ditches can be used to drain the substratum.

Colemantown soils have a high available water capacity. Organic-matter content and natural fertility are high. Fertilizers do not leach readily. Because they drain so slowly, these soils warm late in spring. In many places Colemantown soils are in frost pockets. The soils generally are very strongly acid and require large amounts of lime. In places, however, the substratum is only slightly acid or nearly neutral.

The native vegetation on Colemantown soils is a hardwood forest consisting of mostly pin oak, willow oak, swamp white oak, southern red oak, sweetgum, beech, white ash, hickory, elm, red maple, and blackgum trees. The understory of arrowwood, spicebush, and poison-ivy is dense. Sweetgum trees invade fields left idle and grow for more than 50 years before other hardwoods become established.

About three-fourths of the acreage of Colemantown soils has been cleared for crops. Adequate drainage and ditch maintenance are of the utmost importance. Since this maintenance depends on many property owners, it often is not kept up. When this happens, farming is abandoned and the areas revert to forest.

These soils are suitable for dug ponds, though recharge rates are slow in places. Where they are not too acid, the ponds are excellent for fish.

Typical profile of Colemantown loam in a formerly plowed field adjacent to the Medford Public Hunting Tract:

Ap—0 to 10 inches, dark greenish-gray (5GY 4/1) heavy loam; common, fine, prominent mottles of strong brown (7.5YR 5/8) and few, fine, yellowish-red (5YR 4/8) mottles; moderate, medium, granular structure; friable, sticky and plastic when wet; abrupt, smooth boundary; horizon 8 to 12 inches thick.

B1g—10 to 16 inches, dark greenish-gray (5GY 4/1) sandy clay loam; common, fine and medium, prominent mottles of strong brown (7.5YR 5/8) in ped interiors; moderate, medium, subangular blocky structure; friable, sticky and plastic when wet; glauconite content high; clear, smooth boundary; horizon 4 to 10 inches thick.

B2tg—16 to 24 inches, dark greenish-gray (5GY 4/1) sandy clay; common, fine and medium, prominent mottles of yellowish brown (10YR 5/8) in ped interiors; moderate, medium, subangular blocky and angular blocky structure; friable, sticky and plastic when wet; clay films of dark greenish gray; few iron concretions; glauconite content high; gradual, smooth boundary; horizon 6 to 18 inches thick.

B3—24 to 34 inches, dark-olive (5Y 3/3) clay loam; weak, moderate, subangular blocky structure; friable. sticky and plastic when wet; sand grains coated with clay; glauconite content high; gradual, smooth boundary; horizon 6 to 18 inches thick.

C1—34 to 50 inches, dark-olive (5Y 2/3) alternating layers of clay loam and sandy loam; few, medium and coarse, distinct mottles of very dark grayish brown (10YR 3/2); massive; friable, sticky and plastic when wet; sand grains coated with clay; glauconite content very high; gradual, smooth boundary.

C2—50 to 60 inches, dark-olive (5Y 2/3) alternating layers of sandy loam and sandy clay loam; massive; friable, sticky and plastic when wet; few concretions as much as 1 inch in diameter; glauconite content very high.

The Ap horizon is 5Y or 5GY in hue, ranges from 2 to 4 in value, and is 1 or 2 in chroma. Mottles are 10YR to 5YR in hue, 4 or 5 in value, and 8 in chroma. The undisturbed soil has an A1 horizon 4 to 8 inches thick, which is mixed with the underlying layer where the soil is plowed.

The B horizon is 5GY or 5Y in hue, 3 or 4 in value, and ranges from 1 to 4 in chroma. Mottles in the B horizon range from 10YR to 7.5YR in hue, are 5 in value, and range from 6 to 8 in chroma. The B horizon generally is sandy clay, clay, or heavy clay loam, but commonly it is sandy clay loam in the upper part.

In most places the C horizon consists of stratified layers of dark-olive sandy loam to clay loam containing mottles.

Colemantown soils are associated mostly with Kresson, Marlton, Adelphia, and Holmdel soils. Colemantown soils occur in lower positions than these associated soils and are more poorly drained. They are more gray or darker than Kresson and Marlton soils. They contain more glauconite and have a finer textured B horizon than the Adelphia and Holmdel soils. Although they have a finer texture, are greener, and have a more glauconitic B horizon, Colemantown soils are somewhat similar to the Shrewsbury and Keansburg soils.

Colemantown loam (Cm).—This soil has the profile described as typical for the series. Included with this soil in mapping are areas of clay loam and small areas that have a very dark surface layer 6 or 8 inches thick. Also included are some extensive flats north of Woodlane that are not consistently highly glauconitic. Although the soils in these areas are browner in the surface layer and subsoil than Colemantown loam, they have a fine, mostly clay subsoil and they behave like Colemantown loam. These areas appear to be Pleistocene lake deposits of material from the Hornerstown marl and the Woodbury and Merchantville clay Formations. (Capability unit IIIw–20; woodland suitability group 3w2)

Collington Series

The Collington series consists of well-drained, loamy soils that contain moderate amounts of glauconite. The subsoil contains more clay than the surface layer, and it is generally olive brown. These soils occur in high positions and have slopes of as much as 10 percent. They formed in marine deposits.

In a typical profile the surface layer is dark grayish-brown fine sandy loam about 10 inches thick. The subsurface layer is light olive-brown fine sandy loam about 4 inches thick. The subsoil is olive-brown loam that extends to a depth of about 38 inches. It crumbles easily under slight hand pressure when moist. The substratum consists of stratified yellowish-brown loamy sand and sandy loam.

Collington soils have a high available water capacity and moderate organic-matter content. Permeability is moderately slow in the subsoil and moderate in the substratum. These soils are moderately high in fertility, and they respond well to added fertilizer. Except where they have been limed, these soils are very strongly acid. The lesser slopes are well suited to irrigation, and most high-value crops are irrigated.

Native vegetation is a hardwood forest that consists

of red oak, yellow-poplar, hickory, ash, and beech and an understory of viburnums. Most of the acreage of Collington soils has been cleared for crops. These soils are well suited to fruit, vegetables, corn, small grains, soybeans, hay, and pasture. Most of the potatoes in the county are grown on these soils.

Typical profile of Collington fine sandy loam, 0 to 2 percent slopes, in a cultivated field 1 mile north of Jacobstown:

Ap—0 to 10 inches, dark grayish-brown (2.5Y 4/2) fine sandy loam; weak, fine, granular structure; friable; glauconite common; clear, smooth boundary; horizon 8 to 14 inches thick.

A2—10 to 14 inches, light olive-brown (2.5Y 5/6) fine sandy loam; very weak, fine, granular structure; very friable; glauconite and mica common; clear, smooth boundary; horizon 0 to 8 inches thick.

B1—14 to 20 inches, olive-brown (2.5Y 4/4) loam; weak, medium and coarse, subangular blocky structure; friable, slightly sticky and plastic when wet, hard when dry; sand grains bridged; pores common, glauconite and mica common; gradual, smooth boundary; horizon 0 to 8 inches thick.

B21t—20 to 32 inches, olive-brown (2.5Y 4/4) heavy loam; moderate, medium and coarse, subangular blocky structure; friable, sticky and plastic when wet, hard when dry; pores common; thin patchy clay films on ped faces; glauconite content moderate; mica common; gradual, smooth boundary; horizon 12 to 24 inches thick.

B22—32 to 38 inches, olive-brown (2.5Y 4/4) loam; weak, medium, subangular blocky structure; friable, sticky and plastic when wet; sand grains bridged; glauconite content moderate; clear, smooth boundary; horizon 0 to 10 inches thick.

C—38 to 60 inches, yellowish-brown (10YR 5/6) layers of loamy sand and sandy loam; single grain or massive; loose or very friable; mica and glauconite content moderate.

In the higher positions in the county, these soils have a more oxidized and redder profile than in the typical one. Small amounts of quartzose gravel that were deposited by glacial melt water occur in places.

The B horizon ranges from heavy sandy loam to sandy clay loam. It ranges from 1 to 3 feet in thickness, but average thickness is 1½ to 2 feet.

These soils are associated mostly with Adelphia, Freehold, and Marlton soils. Collington soils lack the mottling that commonly occurs in Adelphia soils and the dark-olive sandy clay subsoil that commonly occurs in Marlton soils. They have a higher glauconite content than Freehold soils.

Collington fine sandy loam, 0 to 2 percent slopes (CnA).—This soil has the profile described as typical for the series. Included with this soil in mapping are small areas of Adelphia soil that are less well drained than this soil. Where high-value crops are grown in these included areas, spot drainage or surface drainage may be needed.

This Collington soil is well suited to all crops grown in the area and requires no special management. (Capability unit I–5; woodland suitability group 1o1)

Collington fine sandy loam, 2 to 5 percent slopes (CnB).—The profile of this soil is similar to that described as typical for the series. Where this soil is farmed, the hazard of erosion is moderate. Erosion is controlled by the use of cover crops, contour farming, or stripcropping. (Capability unit IIe–5; woodland suitability group 1o1)

Collington fine sandy loam, 5 to 10 percent slopes (CnC).—Except that the surface layer is only about 9 inches thick, the profile of this soil is similar to that described as typical for the series.

Where this soil is farmed, the erosion hazard is severe. In places, erosion has exposed some of the subsoil. To reduce the erosion hazard, gullies need to be filled and contour strips, terraces, and grassed waterways may be needed. Where apples are grown, a permanent grass sod should be established. (Capability unit IIIe–5; woodland suitability group 1o1)

Collington loam, 0 to 2 percent slopes (CoA).—Except that the surface layer of this soil contains a little more clay and less sand, the profile of this soil is similar to that described as typical for the series. This soil warms a little more slowly in spring than Collington fine sandy loam, 0 to 2 percent slopes. Also, it has a slightly higher available water capacity and is a little more subject to frost heave. Included with this soil in mapping are small areas of Adelphia soils that may need spot drainage or surface drainage.

This Collington loam is suited to all crops grown in the area. (Capability unit I–4; woodland suitability group 1o1)

Collington loam, 2 to 5 percent slopes (CoB).—Except that it has a loam surface layer, the profile of this soil is similar to that described as typical for the series. The hazard of erosion is moderate.

Management practices, such as the use of cover crops, contour farming, or stripcropping, are needed to control erosion where this soil is farmed. (Capability unit IIe–4; woodland suitability group 1o1)

Donlonton Series

The Donlonton series consists of somewhat poorly drained, nearly level soils that contain small amounts of glauconite. These soils have a moderately fine textured subsoil. They normally are below Keyport soils and above the Colemantown and Shrewsbury soils. Donlonton soils receive runoff and substratum water from the slopes above. They formed primarily in soil material weathered from the Merchantville and Woodbury Formations, but in many places this material was transported downslope before Donlonton soils formed.

In a typical profile the plow layer is dark-brown loam about 10 inches thick. The subsoil is clay loam that extends to a depth of about 36 inches. It is dark yellowish brown to a depth of 28 inches and dark gray below. The subsoil is mottled throughout. The substratum is brown sandy loam to a depth of 48 inches and dark-gray clay loam below. It is distinctly mottled in the upper part and faintly mottled in the lower part.

Donlonton soils are slowly permeable and have a high available water capacity. Few areas are irrigated. Excess water occurs in the surface layer and also in the substratum where it contains sandy layers. Water accumulates on the surface in December and lasts until April, but it does not saturate the subsoil. Because Donlonton soils warm late in spring and cannot be worked soon after rains, they need surface drainage (fig. 10).

Donlonton soils are moderate in organic-matter content and fertility. Added fertilizers do not leach read-

Figure 10.—Surface drainage of Donlonton loam, 0 to 3 percent slopes, prevents ponding and loss of crops.

ily. Since these soils are very strongly acid, they need large additions of lime.

The native vegetation is a hardwood forest. Pin oak, willow oak, and swamp white oak are the main trees, but there are also scattered hickory, ash, beech, yellow-poplar, and sweetgum.

In most places the Donlonton soils have been cleared for crops. The main crops are corn, small grains, soybeans, hay, and pasture, but late-planted vegetables are grown in some places.

Typical profile of Donlonton loam, 0 to 3 percent slopes, in a formerly cultivated field 0.2 mile north of Woodlane Road opposite the brickyard road in Willingboro Township:

Ap—0 to 10 inches, dark-brown (10YR 4/3) loam; moderate, medium, crumb structure; friable, slightly sticky and slightly plastic when wet; many fine and medium pores; glauconite content low; abrupt smooth boundary; horizon 8 to 12 inches thick.

B2t—10 to 28 inches, dark yellowish-brown (10YR 4/4) clay loam, yellowish brown (10YR 5/6) when crushed; few to many, fine, faint and distinct mottles of dark clay (10YR 4/1), dark brown (7.5YR 3/2), strong brown (7.5YR 5/6) in ped interior; prismatic and moderate, coarse, angular blocky or subangular blocky structure; firm or very firm when moist, plastic when wet, very hard when dry; many fine pores; thin patchy clay films on ped faces; about 1 percent is rounded quartzose pebbles as much as 2 inches in diameter; glauconite content low; brown coats on weathered glauconite grains; abrupt, smooth boundary; horizon 10 to 30 inches thick.

B3—28 to 36 inches, dark-gray (10YR 4/1) clay loam, yellowish brown (10YR 5/6) when crushed; many, medium, prominent mottles of yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) in ped interiors; weak, medium, subangular blocky structure; friable, sticky and plastic when wet; many fine pores; about 1 percent is rounded quartzose pebbles as much as 2 inches in diameter; mica and glauconite content low; glauconite grains weathered brown; abrupt smooth boundary; horizon 6 to 20 inches thick.

C1—36 to 48 inches, brown (10YR 5/3) sandy loam; common, medium, distinct mottles; massive; friable; 1 to 5 percent is rounded quartzose pebbles as much as 2 inches in diameter; glauconite content low; abrupt, smooth boundary; horizon 0 to 18 inches thick.

IIC2—48 to 60 inches, dark-gray (10YR 4/1) clay loam; few, fine, faint mottles; massive; firm when moist, plastic when wet, hard when dry; iron-cemented sheets in cracks; mica content low; glauconite content low.

Rounded pieces of quartzose gravel may occur in varying amounts in any horizon except the underlying clay layer. These pieces are normally less than 3 percent of the horizon.

Wooded soils have a dark A1 horizon about 4 inches thick. Where plowed, this horizon is mixed with the underlying horizon to form the Ap horizon. The Ap horizon is 3 or 4 in value and 2 or 3 in chroma. A yellowish-brown A2 horizon occurs in places.

The B horizon is dominantly clay loam, but it includes clay, silty clay, and sandy clay in places. It ranges from 10YR to 7.5YR in hue, is 4 in value, and ranges from 1 to 4 in chroma. Mottles are 10YR or 7.5YR in hue. They range from 3 to 5 in value and from 1 to 6 in chroma.

The C horizon ranges from 10YR to 5Y in hue, from 3 to 5 in value, and from 1 to 6 in chroma. Texture ranges from sandy loam to clay. Because the finest texture generally is directly below the solum, free percolation is prevented. Where sandy layers are present, they become saturated and water moves laterally over the underlying layer.

Donlonton soils are associated mostly with Keyport, Colemantown, and Shrewsbury soils. Mottles are closer to the surface in Donlonton soils than in Keyport soils. Donlonton soils are not so olive or so gray as Colemantown or Shrewsbury soils.

Donlonton fine sandy loam, 0 to 3 percent slopes (DeB).—This soil has a surface layer of fine sandy loam about 14 inches thick; otherwise its profile is similar to that described as typical for the series. Because of the fine sandy loam surface layer, this soil warms early and is easy to work. It is better suited to vegetables than Donlonton loam, 0 to 3 percent slopes. In many areas, however, surface drainage is needed to prevent ponding. (Capability unit IIw–12; woodland suitability group 2w1)

Donlonton loam, 0 to 3 percent slopes (DlA).—This soil has the profile described as typical for the series. Included with this soil in mapping are areas of Keysport, Holmdel, and Shrewsbury soils. The Donlonton loam warms slowly and cannot be worked for some time after heavy rains. (Capability unit IIw–11; woodland suitability group 2w1)

Downer Series

The Downer series consists of well-drained soils that, in most places, have a light sandy loam subsoil over a sandier substratum. The subsoil contains no glauconite. The most extensive Downer soils are nearly level and gently sloping, but in about 5 percent of the acreage slopes are 5 to 10 percent. Downer soils are moderately shallow over sandy underlying material (IIC horizon).

In a typical profile the surface layer is dark grayish-brown loamy sand about 10 inches thick. The subsurface layer is yellowish-brown loamy sand about 7 inches thick. The subsoil is yellowish-brown light sandy loam that extends to a depth of about 28 inches. The underlying layers are brownish-yellow stratified sand and loamy sand.

Downer soils are moderately permeable and have a low available water capacity. They seldom, if ever, contain excess or free water. They are low in organic-matter content and fertility. Because added fertilizers

leach readily, raising fertility is difficult. Downer soils warm early and are easily worked. Extensive exposed areas are subject to soil blowing.

The native vegetation on Downer soils is a hardwood forest that consists mostly of black oak, white oak, scarlet oak, chestnut oak, and hickory and scattered pitch, shortleaf, and Virginia pines. Where wildfires have been common, the proportion of pitch pine is higher and the scarlet oak is missing. Where wildfires have been severe, the stand is mostly pitch pine, scrub oak, blackjack oak, and black oak.

The most extensive areas of Downer soils that have been cleared for farming are near Tabernacle and Indian Mills. Some acreage was cleared at Tylertown, but this has mostly reverted to forest. Pines seed readily in areas left idle.

Except where management is good, Downer soils are not well suited to crops. They are poorly suited to hay, pasture, and corn. High-value crops need irrigation. Irrigated sweet corn and other early vegetables are commonly grown. These soils are fairly well suited to nonirrigated sweet potatoes, pumpkins, and cantaloupes if rainfall is normal. Downer soils are very strongly acid and require additions of lime at short intervals.

Typical profile of Downer loamy sand, 0 to 2 percent slopes, in an abandoned field about 1.4 miles south of State Route 70 at Burrs Mill:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) loamy sand; very weak, fine, granular structure; very friable; roots abundant; abrupt, smooth boundary; horizon 7 to 12 inches thick.

A2—10 to 17 inches, yellowish-brown (10YR 5/6) loamy sand; very weak, fine, granular structure; very friable, nonsticky, roots abundant; very few pebbles; gradual, smooth boundary; horizon 4 to 10 inches thick.

B2t—17 to 28 inches, yellowish-brown (10YR 5/4) light sandy loam; very weak, fine and medium, subangular blocky structure; very friable, nonsticky, nonplastic; roots common; pores common; clay bridges on sand grains common; abrupt, wavy boundary; horizon 9 to 20 inches thick.

IIC—28 to 60 inches, stratified brownish-yellow (10YR 6/6) coarse sand containing discontinuous layers of loamy sand; sand is single grain, loose, and nonsticky; loamy sand is massive and friable or firm; 10 to 15 percent of horizon is rounded quartzose pebbles less than 1 inch in diameter.

The solum of Downer soils ranges from 20 to 32 inches in thickness. Wooded soils have a very dark A1 horizon about 4 inches thick and a bleached A2 horizon about 4 inches thick. Where the soil is plowed, the A1 and A2 horizons are mixed to form the Ap horizon. This Ap horizon is 2.5Y in hue in places.

The B horizon normally does not contain much more clay than the A horizon, though the clay increase in the B horizon is more apparent where the surface layer is loamy sand. The B horizon is 10YR in hue, 5 in value, and 4 or 6 in chroma.

The IIC horizon is sand or gravelly sand in most places. Discontinuous layers of sandy loam weakly cemented by iron are common, especially where the IIC horizon reaches the water table. Where gravel makes up 50 percent or more of this horizon, the area is mapped separately.

Downer soils are associated mostly with Sassafras, Evesboro, Woodmansie, and Woodstown soils. The subsoil of Downer soils is coarser textured than that of the Sassafras soils and finer textured than that of the Evesboro soils. The Downer soils lack the thick, bleached, gray A2 horizon of the Woodmansie soil and the mottling that is common in the Woodstown soil.

Downer loamy sand, 0 to 2 percent slopes (DoA).—This soil has the profile described as typical for the series. Included with this soil in mapping are small areas of Sassafras, Evesboro, Woodstown, and Woodmansie soils and of Downer soils that have slopes of more than 2 percent. Also included, near Tabernacle, Indian Mills, and Mount, are soils that contain considerable fine sand and have a better available water capacity than Downer loamy sand, 0 to 2 percent slopes. Small included areas of sandy loam also have a higher available water capacity.

Most of this Downer loamy sand is woodland that needs protection from wildfires. Also needed in extensive exposed areas is protection from soil blowing. Windbreaks, cover crops, and stripcropping are used for this purpose. (Capability unit IIs-6; woodland suitability group 3o1)

Downer loamy sand, 2 to 5 percent slopes (DoB).—This soil has a profile similar to that described as typical for the series. Where this soil is farmed and slopes are long, the hazard of erosion is moderate. Cover crops and contour farming have been used to control erosion. Most of this soil is woodland that needs protection from wildfires. (Capability unit IIs-6; woodland suitability group 3o1)

Downer loamy sand, 5 to 10 percent slopes (DoC).—This soil has a profile similar to that described as typical for the series, but in areas cleared for farming, some fields are gullied or have had gullies filled with material from adjacent soils.

Most of this soil is woodland that needs protection from wildfires. In cultivated areas, runoff is rapid and the hazard of erosion is severe. Contour farming and diversion terraces are used to reduce erosion. (Capability unit IIIe-6; woodland suitability group 3o1)

Downer loamy sand, gravelly substratum, 0 to 5 percent slopes (DpB).—The gravelly substratum of this soil is at least 2 feet thick and at least 50 percent gravel. The gravel consists of rounded quartzose pebbles that are mostly less than 2 inches in diameter. Except for this gravelly layer, this soil has a profile similar to that described as typical for the series.

Most of this soil is woodland that needs protection from wildfires. Few areas have been cleared for farming. In cultivated areas the longer slopes need protection against erosion. Protection against soil blowing is needed where exposed fields are extensive. Some areas of this soil may be suitable as sources of gravel for local use. (Capability unit IIs-6; woodland suitability group 3o1)

Downer loamy sand, loamy substratum, 0 to 2 percent slopes (DrA).—Except that the subtratum has finer textured layers, this soil has a profile similar to that described as typical for the series. The finer texture in the substratum generally is at a depth of 40 to 60 inches, but in places it is only 30 inches below the surface. In most places this substratum is sandy clay loam. Although this layer increases the available water capacity, only deep-rooted plants benefit from the increase. Permeability of the loamy substratum is

moderate in most places; but it ranges to slow in places.

Included with this soil in mapping are areas of Sassafras, Woodstown, and Woodmansie soils. Also included are Evesboro and Lakewood soils that have a loamy substratum and small areas of Downer loamy sand, 5 to 10 percent slopes. In a few included areas the substratum is sandy clay or clay.

This soil is mostly woodland that needs protection from wildfires. Few areas have been cleared for farming. (Capability unit IIs–6; woodland suitability group 3o1)

Downer sandy loam, truncated, 0 to 5 percent slopes (DsB).—About 12 to 14 inches of the original surface layer of this soil has been removed for use as topsoil, and the former subsoil is now at the surface. Except for this truncated surface layer, this soil has a profile similar to that described as typical for the series. In Burlington County this soil occurs only within Fort Dix Military Reservation.

Because erosion is a severe hazard, areas not protected are seeded with perennial grasses and legumes. Seeded areas are fertilized heavily to produce a good cover and to increase the organic matter in the surface layer. In some places this soil is used for plants that provide food and cover for wildlife. (Capabilit unit IIIe–6; woodland suitability group 3o1)

Evesboro Series

The Evesboro series consists of deep, loose, excessively drained sands. Where the surface layer is bleached, it is gray and less than 6 inches thick. Evesboro soils are in high positions and are mainly nearly level or gently sloping, but slopes are as much as 10 percent in some places.

In a typical profile of a wooded soil, the surface is covered with about 1 inch of organic matter and grains of quartz. The surface layer is gray sand about 3 inches thick over yellowish-brown sand that extends to a depth of about 26 inches. The substratum is stratified yellowish-brown sand and loamy sand.

Evesboro soils are rapidly permeable in most places, but they have moderately rapid permeability where the surface layer is fine sand. Evesboro soils have a low available water capacity. They are very strongly acid, low in fertility, and low in content of organic matter. Added fertilizers leach readily. These soils warm quickly early in spring and are easily worked. They are so hot in summer that they scald some vegetables. If left idle, they are subject to soil blowing.

The native vegetation is a forest of mixed oaks and pitch pine. Where wildfires have been severe, the forest consists of pitch pine, scrub oak, and blackjack oak. Pines generally seed naturally in cleared areas left idle.

Few areas of these soils have been cleared for farming. They are too droughty to be suitable for most crops, though peaches, sweetpotatoes, and small fruits are grown on Evesboro soils in adjacent counties.

Typical profile of Evesboro sand, 0 to 5 percent slopes, in a predominantly oak stand in the western side of Lebanon State Forest near Deep Hollow:

O—1 inch to 0, very dark brown (10YR 2/2) matted organic matter and individual grains of clean quartz.

A1—0 to 3 inches, gray (10YR 5/1), clean sand; single grain; loose; clear, wavy boundary; horizon 2 to 6 inches thick.

A3—3 to 26 inches, yellowish-brown (10YR 5/4) sand; single grain; loose; particles coated; about 2 percent of horizon is rounded quartzose pebbles that are as much as 2 inches in diameter in the lower part; clear, smooth boundary; horizon 6 to 30 inches thick.

C—26 to 60 inches, alternating layers of yellowish-brown (10YR 5/6) sand and loamy sand; single grain except for thin massive layers; loose except for thin friable layers; sand grains coated in upper part of horizon, clean in lower part; 0 to 10 percent of horizon is rounded quartzose pebbles as much as 2 inches in diameter.

In most places the Evesboro soils are medium and coarse sands, but a fine sand occurs in some places. In places there are sandy loam layers below a depth of 40 inches. The rounded quartzose pebbles generally are not abundant.

Evesboro soils are associated mostly with Lakewood, Klej, Lakehurst, and Downer soils. Evesboro soils are not bleached so deeply as theLakewood soils. They lack the mottling that is common in Klej and Lakehurst soils and the sandy loam subsoil of the Downer soils.

Evesboro sand, 0 to 5 percent slopes (EvB).—This soil has the profile described as typical for the series. In a few places loamy layers occur at a depth of 30 to 60 inches. These layers increase the available water capacity and the suitability of this soil for deep-rooted plants such as trees. Included with this soil in mapping are areas of loamy sand.

Where this soil is farmed in extensive exposed areas, it needs protection from soil blowing. Protection can be provided by rye strips, cover crops, or windbreaks. Where this soil is irrigated, frequent applications of water are needed. If the soil is not compacted, it absorbs water readily. (Capability unit VIIs–7; woodland suitability group 3s1)

Evesboro sand, 5 to 10 percent slopes (EvC).—This soil has a profile similar to that described as typical for the series. Most slopes are short. Included with this soil in mapping are areas that have slopes of more than 10 percent. Because the sand is loose, this soil is subject to severe erosion if it is left idle. (Capability unit VIIs–7; woodland suitability group 3s1)

Evesboro sand, loamy substratum, 0 to 5 percent slopes (EwB).—This soil has sandy loam or sandy clay loam layers, generally at a depth of 40 to 60 inches but in some places as near the surface as 30 inches. In a few places the substratum is finer textured than sandy clay loam. In other respects, this soil has a profile similar to that described as typical for the series. (Capability unit IVs–7; woodland suitability group 3s1)

Evesboro fine sand, 0 to 5 percent slopes (EyB).—This soil generally is fine sand to a depth of 40 inches, though in places it is fine sand only to a depth of 30 inches. Except for the texture of the surface layer, this soil has a profile similar to that described as typical for the series.

This soil has a slightly higher available water capacity than Evesboro sand, 0 to 5 percent slopes, and is more subject to soil blowing. Permeability is moderately rapid. (Capability unit IVs–7; woodland suitability group 3s1)

Fallsington Series

The Fallsington series consists of nearly level fine sandy loams that are grayish colored and distinctly mottled. Texture is abruptly coarser than fine sandy loam at a depth of 2½ to 3½ feet. Fallsington soils form in water-deposited sediments in low positions, where they receive much runoff from the slopes above. They also occur on extensive flats that lack deeply cut natural drains. One such flat is south of Tabernacle. These soils are poorly drained, and some areas are ponded late in winter.

In a typical profile, the surface layer is dark-gray fine sandy loam about 12 inches thick and the subsurface layer is light-gray sandy loam about 2 inches thick. The subsoil is mottled grayish-brown sandy loam that extends to a depth of about 34 inches. The underlying material is alternating layers of sand and loamy sand.

Fallsington soils are moderate in fertility and available water capacity. They are moderately high in organic-matter content. Except where they have been heavily limed, these soils are very strongly acid. Fallsington soils are moderately permeable in the subsoil and more rapidly permeable in the substratum. Generally, they are saturated 6 to 8 months of the year and the water table drops below 3 feet in summer, though it may be higher when rains are heavy. It rises early in fall and remains high until late in spring. These soils warm slowly in spring, and areas in low positions are commonly in frost pockets.

The native vegetation is a hardwood forest consisting of pin oak, willow oak, swamp white oak, blackgum, and red maple. Sweetgum seeds naturally in abandoned areas that have seed trees nearby. Pitch pine seeds readily in the outer Coastal Plain. Generally the understory is dense and consists of highbush blueberry, sheep laurel, gallberry, sweet pepperbush, bayberry, and greenbrier.

In most places these soils have been cleared and are used mostly for corn, soybeans, pasture, hay, and late-planted vegetables. Where they are planted to blueberries, a system that controls the water level is highly desirable. Fallsington soils are not suited to alfalfa, fruit, asparagus, or other vegetables that cannot withstand wetness.

These soils need drainage if they are to be used for crops. Winter small grains are subject to drowning on Fallsington soils unless they are drained. These soils do not support farm equipment where the water table is high. Either underdrains or ditches can be used to lower the water table. Excess water cannot be removed entirely from these low soils, but drainage permits wider uses.

Fallsington soils generally are suitable sites for dug ponds.

Typical profile of Fallsington fine sandy loam in a cultivated field west of Tabernacle:

Ap—0 to 12 inches, dark-gray (10YR 4/1) fine sandy loam: weak, fine and medium, granular structure; very friable, nonsticky; roots abundant; gradual, wavy boundary; horizon 8 to 14 inches thick.

A2g—12 to 14 inches, light-gray (10YR 6/1) light sandy loam, white (10YR 8/1) when dry; weak, medium, granular structure; very friable; nonsticky; roots common; gradual, wavy boundary; horizon 0 to 4 inches thick.

B2tg—14 to 34 inches, grayish-brown (10YR 5/2) sandy loam; common, fine and medium, distinct mottles of yellowish brown (10YR 5/6); moderate, coarse, subangular blocky structure; friable; nonsticky, nonplastic; roots generally restricted to the ped faces; discontinuous clay films on ped faces; numerous fine pores; abrupt, wavy boundary; horizon 12 to 24 inches thick.

IICg—34 to 60 inches, stratified light-gray (10YR 7/1) sand, white (10YR 8/1) when dry, and thin layers of grayish-brown (10YR 5/2) loamy sand, white (5Y 8/2) when dry; single grain; loose; nonsticky, nonplastic; very few roots.

The solum generally is about 30 inches thick, but it ranges from 20 to 40 inches in thickness. Although small amounts of rounded quartzose pebbles may occur in any horizon, they are most common in the IIC horizon and the A horizon.

The Ap horizon is sandy loam in places. It ranges from 4 to 5 in value and is 1 or 2 in chroma. Unplowed Fallsington soils have a very dark A1 horizon 2 to 4 inches thick.

The B2tg horizon ranges from sandy loam to sandy clay loam. Sandy loam is most common in the outer Coastal Plain, and sandy clay loam is most common in the inner Coastal Plain. The B2tg horizon ranges from 5Y to 10YR in hue and is 4 or 5 in value.

The IICg horizon generally consists of alternating layers that range from sand to sandy loam. The finer layers determine permeability. The IICg horizon ranges from gray to strong brown, and it lacks mottling in places. In places it ranges from sandy clay loam to clay.

These soils generally are associated with Pocomoke and Woodstown soils. Fallsington soils are more gray than Woodstown soils and lack the black A horizon that is common in Pocomoke soils. Because they form in nonglauconitic sediments, Fallsington soils lack the greenish-gray and olive-gray colors that commonly occur in Shrewsbury soils that formed in glauconitic sediments.

Fallsington fine sandy loam (Fa).—This soil has the profile described as typical for the series. Included with nearly all mapped areas of this soil are spots of Pocomoke and Woodstown soils. In some areas the substratum includes clayey layers, and in these areas water recharge may be slow in dug ponds.

Underdrains or ditches are needed for best crop growth. Erosion of banks of ditches can be reduced if the soil is stabilized by vegetation. (Capability unit IIIw–21; woodland suitability group 3w2)

Fallsington fine sandy loam, clayey substratum (Fc).—Except for the presence of clayey layers in the substratum, this soil has a profile similar to that described as typical for the series. In most places these clayey layers are 6 to 12 inches thick, and they generally occur at a depth of 40 to 60 inches. In a few areas the layers are at a depth of only 30 inches. Included with this soil in mapping are areas where the substratum is sandy clay loam.

In the western part of the county, this soil forms over thick beds of dark-colored clay or clay loam that are extremely acid in many places. Where ponds are dug into these beds, the water becomes so acid that most fish do not reproduce. These ponds also have a slow recharge rate.

The clayey layers are fine enough to slow percolation. Where deep ditches are used to lower the water table, the thin layers are penetrated and percolation rates increased.

Where this soil is used for crops, it requires drainage by underdrains or ditches. Underdrains must be kept above the thick beds of clay. Erosion of ditchbanks can be reduced by sloping the banks, and seeding them to protective plants. (Capability unit IIIw-21; woodland suitability group 3w2)

Freehold Series

The Freehold series consists of well-drained, sandy and loamy soils that have a moderately high or high available water capacity. These soils, which generally formed in glauconitic marine deposits, contain small amounts of glauconite. Freehold soils are mostly nearly level or gently sloping, but they range to steep.

In a typical profile the suface layer is dark grayish-brown fine sandy loam about 11 inches thick. The subsurface layer is light olive-brown fine sandy loam about 4 inches thick. A dark yellowish-brown subsoil extends to a depth of about 35 inches. It is fine sandy loam in the upper part, sandy clay loam in the middle, and fine sandy loam in the lower part. The underlying material extends to a depth of at least 60 inches and is stratified light olive-brown loam and olive-brown fine sandy loam.

Freehold soils are moderately or moderately slowly permeable. Except for a day or two after extremely heavy rains, these soils do not contain free water within 60 inches of the surface. High-value crops are irrigated. Fertility is moderate or moderately high. Added fertilizers do not leach readily, and response to them is good. Freehold soils warm moderately early in spring and are easily worked. Organic-matter content ranges from moderate in the fine sandy loams to low in the loamy sands. Except where they have been heavily limed, Freehold soils are very strongly acid.

The native vegetation is a fast-growing forest of red oak, white oak, scarlet oak, yellow-poplar, beech, and hickory. Freehold soils are well suited to crops and are the most extensively farmed soils in the county. Nearly all areas of gently sloping soils have been cleared for farming. These soils are well suited to fruit, vegetables, grain, hay, pasture, nursery plants, and cultivated sod.

Typical profile of Freehold fine sandy loam, 0 to 2 percent slopes, in a cultivated peach orchard west of Cropwell Road south of State Route 73:

Ap—0 to 11 inches, dark grayish-brown (2.5Y 4/2) fine sandy loam; weak, fine, granular structure; friable; glauconite content low; abrupt, smooth boundary; horizon 10 to 12 inches thick.

A2—11 to 15 inches, light olive-brown (2.5Y 5/4) fine sandy loam; weak, medium, subangular blocky structure that has platy tendencies; very friable; glauconite content low; abrupt, smooth boundary; horizon 4 to 10 inches thick.

B1—15 to 22 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; moderate, medium, subangular blocky structure; friable, slightly sticky and slightly plastic when wet; glauconite content low; gradual, wavy boundary; horizon 0 to 8 inches thick.

B2t—22 to 30 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; moderate, medium, subangular blocky structure; friable, slightly sticky and plastic when wet; sand grains bridged; glauconite content low; gradual, wavy boundary; horizon 6 to 18 inches thick.

B3—30 to 35 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; weak, medium, subangular blocky structure; very friable; glauconite content low; abrupt, smooth boundary; horizon 0 to 12 inches thick.

C—35 to 60 inches, alternating layers of light olive-brown (2.5Y 5/4) loamy sand and olive-brown (2.5Y 4/4) fine sandy loam; loamy sand layers are single grain, loose; sandy loam layers are massive, friable or slightly firm; glauconite content low; mass speckled by unweathered dark glauconite grains.

In places Freehold soils have small amounts of rounded quartzose gravel. The glauconite content of the subsoil ranges from 1 to 10 percent. In places where there is a sandy deposit on the surface, glauconite is absent or is so weathered that it cannot be recognized.

The solum ranges from 30 to 40 inches in thickness. Where the underlying material is different from the normal stratified sandy beds, the soil is mapped separately.

In areas that have not been plowed, there are a nearly black A1 horizon, 2 to 4 inches thick, and a lower bleached gray horizon, 2 to 4 inches thick. Both horizons are destroyed when the soil is plowed.

The Ap horizon ranges from 2.5Y to 10YR in hue, is 4 or 5 in value, and ranges from 2 to 4 in chroma. The A2 horizon ranges from 2.5Y to 7.5YR in hue and is 4 or 5 in value.

The B horizon ranges from 10YR to 5YR in hue, is 4 or 5 in value, and ranges from 4 to 6 in chroma. In high positions, where oxidation takes place freely, the color of the B horizon is redder than normal. This is especially true in North Hanover Township at elevations above 150 feet, where iron concretions are numerous. The B horizon contains about 10 percent more clay than the A horizon.

The C horizon generally contains less clay and appreciably less silt than the B horizon. In places the C horizon is clayey.

Freehold soils are associated mostly with Holmdel, Collington, Sassafras, Westphalia, Keyport, and Marlton soils. Freehold soils lack the mottling common in the Holmdel soils. They contain less glauconite than the Collington and Marlton soils and more glauconite than the Sassafras and Westphalia soils. The content of clay is not so high in Freehold soils as it is in the Keyport and Marlton soils. Freehold soils lack the olive colors that occur in Marlton soils.

Freehold fine sandy loam, 0 to 2 percent slopes (FfA).—This soil has the profile described as typical for the series. Included with this soil in mapping are small areas of Collington, Sassafras, Holmdel, and Keyport soils. Drains may be needed on Holmdel and Keyport soils. Also included and indicated on the map by a circled X are about 200 acres of Freehold fine sandy loam from which the subsoil was removed for use as molding sand. After the subsoil was removed, the topsoil was replaced and the area was farmed again. The soils in these areas have a considerably lower available water capacity than undisturbed Freehold fine sandy loam, 0 to 2 percent slopes, and they need irrigation much sooner.

This soil is suited to nearly all crops grown in the area. Limitations to management are few. (Capability unit I-5; woodland suitability group 1o1)

Freehold fine sandy loam, 2 to 5 percent slopes (FfB).—The use of this soil is limited by runoff and susceptibility to erosion. The hazard of erosion can be reduced by contour farming, stripcropping, and the use of cover crops. The profile of this soil is similar to that described as typical for the series. (Capability unit IIe-5; woodland suitability group 1o1)

Freehold fine sandy loam, 5 to 10 percent slopes (FfC).—This soil has a profile similar to that described as typical for the series. Because runoff is moderate, erosion is a hazard. Erosion can be controlled by the use of contour farming, stripcropping, terraces, and cover crops. A permanent cover is needed in apple orchards. Most of this soil is farmed, but some of it is woodland. (Capability unit IIIe–5; woodland suitability group 1o1)

Freehold fine sandy loam, 10 to 15 percent slopes (FfD).—In farmed areas of this soil, runoff is rapid and the erosion hazard is severe. Erosion is controlled by seeding small grains or pasture plants or by using a cropping system that includes long periods in sod. Apple orchards can be kept in permanent sod. This soil is suited to trees and can be used as a habitat for wildlife. (Capability unit IVe–5; woodland suitability group 1o1)

Freehold fine sandy loam, 15 to 25 percent slopes (FfE).—This soil has short slopes in most places. The lower parts of the slopes contain seepy spots where ground water moving laterally has surfaced. Except that the subsoil is more variable in texture and thickness, the profile of this soil is similar to that described as typical for the series. Included with this soil in mapping are clayey and sandy areas.

Most of this soil is in trees, which grow well. A permanent cover of trees, shrubs, or grasses controls erosion and prevents severe siltation of streams. (Capability unit VIe–5; woodland suitability group 1r1)

Freehold fine sandy loam, clayey substratum, 2 to 5 percent slopes (FgB).—This soil has an underlying clayey layer at a depth of 40 to 60 inches. In most places this layer is a thick, very dark gray deposit that is a part of the Merchantville or Woodbury clay Formations. This clayey layer is so slowly permeable that water perches on it after heavy rains and also moves laterally over it.

In most places the clay is so deep that it does not greatly affect farming. In other places, however, the perched water is so close to the surface that underdrains must be constructed above the clay layer. (Capability unit IIe–5; woodland suitability group 1o1)

Freehold loamy sand, 0 to 5 percent slopes (FhB).—Except for the loamy sand surface layer, this soil has a profile similar to that described as typical for the series. This sandy surface layer is 18 inches thick. Because of it, this soil has a lower available water capacity than Freehold fine sandy loam, 0 to 2 percent slopes, and needs more frequent irrigation. Also, this soil is lower in fertility and in organic-matter content. It warms earlier in spring but is subject to soil blowing. Crops are subject to sand blasting. Included with this soil in mapping are small areas of Holmdel soil that may need drainage.

This soil is better suited to fruit and irrigated vegetables than to corn, soybeans, hay, and pasture. Crops are protected from soil blowing by windbreaks, cover crops, and wind strips. (Capability unit IIs–6; woodland suitability group 2o1)

Freehold loamy sand, 5 to 10 percent slopes (FhC).—This soil has a surface layer of loamy sand 14 inches thick. Except for this surface layer, the profile of this soil is similar to that described as typical for the series. Runoff is moderate, and water erosion is more of a hazard than soil blowing.

Most slopes are not long, but erosion control practices are needed if these soils are to be farmed every year. On the long slopes, erosion can be controlled by contour farming, cover crops, stripcropping, or terracing. Apple orchards can be kept in permanent sod. (Capability unit IIIe–6; woodland suitability group 2o1)

Freehold sandy loam, 5 to 10 percent slopes, severely eroded (FoC3).—This soil is so severely eroded that plowing mixes the more sticky subsoil with the little original surface layer that remains. Organic-matter content is very low, and runoff is rapid. The surface soil crusts as it dries, and this crusting prevents uniform seed germination. Plant growth is irregular and poorer than on uneroded soils. Included with this soil in mapping are small areas of Collington and Westphalia soils.

This soil can be kept in good tilth by frequently adding organic matter or manure and fertilizers and by using cover crops. Cropping systems should provide small grain or sod for long periods. Gullies need to be filled. (Capability unit IVe–5; woodland suitability group 1o1)

Freehold sandy loam, 10 to 15 percent slopes, severely eroded (FoD3).—This soil is so severely eroded that plowing mixes the sticky subsoil with the remaining original surface layer. Runoff is rapid. Some slopes contain seepy spots where ground water moving laterally has surfaced.

Pasture, trees, plantings for wildlife, or other permanent cover is needed to control erosion. Black locust can be planted for posts, or pines for Christmas trees. Large amounts of organic matter are needed to improve the tilth. Gullies need to be filled. (Capability unit VIe–5; woodland suitability group 1o1)

Galestown Series

The Galestown series consists of excessively drained, nearly level or gently sloping sandy soils that have a little more clay in the subsoil than in the surface layer. Galestown soils occur along the Delaware River on a terrace that ranges from 10 to 50 feet in elevation.

In a typical profile the surface layer is very dark grayish-brown sand about 10 inches thick. The subsurface layer, about 13 inches thick, is yellowish-brown sand. The subsoil is strong-brown loamy sand about 15 inches thick. Alternating layers of dark yellowish-brown sand and strong-brown loamy sand make up the underlying material.

Permeability is rapid in forested Galestown soils and moderately rapid in plowed soils. Although the available water capacity generally is low, it is somewhat higher where these soils have a clayey substratum. Only deep-rooted plants, however, benefit from this higher capacity, and nearly all crops are irrigated. The soils warm early in spring and can be worked immediately after heavy rains. In extended

hot spells some crops are scalded by heat reflected from the sand.

Galestown soils are subject to soil blowing that sandblasts crops. These soils are low in organic-matter content and fertility. Added fertilizers leach readily. Unless lime is added at frequent intervals, these soils are very strongly acid.

The native vegetation is a forest consisting mostly of mixed oaks, hickory, and scattered Virginia pines. Virginia pines have seeded naturally in areas left idle, but now they grow in only a few places. Sassafras and wild cherry are common in idle areas.

These soils were formerly used for general crops, but when irrigation was introduced, farmers gradually switched to high-value vegetables. Nearly all areas are now irrigated, and the common crops are sweet corn, peaches, snap beans, and cantaloupes. On some fields two crops are grown in a year.

Because the population is concentrated along the Delaware River, a large acreage of these soils has been taken for residential, commercial, and industrial development.

Typical profile of Galestown sand, 0 to 5 percent slopes, in a cultivated field south of the National Cemetery at Beverly:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) sand; very weak, fine, granular structure; very friable; abrupt, smooth boundary; horizon 8 to 12 inches thick.

A2—10 to 23 inches, yellowish-brown (10YR 5/4) sand; single grain; loose; clear, smooth boundary; horizon 10 to 18 inches thick.

B2t—23 to 30 inches, strong-brown (7.5YR 4/6) loamy sand; very weak subangular blocky structure; very friable; sand grains weakly bridged; gradual, smooth boundary; horizon 7 to 13 inches thick.

B3—30 to 38 inches, strong-brown (7.5YR 4/6) loamy sand; very weak subangular blocky structure; very friable; gradual, smooth boundary; horizon 4 to 8 inches thick.

C—38 to 60 inches, dark yellowish-brown (10YR 4/6) sand containing thin layers of strong-brown (7.5YR 4/6) loamy sand; sand is single grain and loose; loamy sand is massive and friable.

Galestown soils contain varying amounts of rounded quartzose pebbles. Although in most places the amounts are small, some areas within a mile of the Delaware River have thick beds of pebbles and cobblestones 3 to 5 feet below the surface. Because of the community development in most of these areas, they have not been mapped separately.

These soils are mostly fine sand and medium sand throughout the solum, and the texture in the C horizon is about the same.

The A1 horizon is very dark and about 4 inches thick. Plowing mixes this horizon with part of the yellowish-brown A2 horizon, and an Ap horizon is formed. The Ap horizon is 3 or 4 in value and 2 or 3 in chroma. The surface layer is sand, consisting of mostly fine sand, but not enough to make a fine sand texture. The A2 horizon is 7.5YR or 10YR in hue. Thickness of the A horizon averages about 23 inches but ranges from 18 to 27 inches.

The B horizon generally is 7.5YR in hue, but it is 10YR in places. The B2t horizon is loamy sand or sand, though it normally contains 3 to 6 percent more clay than the A horizon.

In places the C horizon has clayey layers or gravel beds. In other areas it consists of material much like that of the A and B horizons, though it has slightly less clay and silt or has thin bands of clay and silt in the upper part.

Galestown soils are associated with Klej and Sassafras soils. They lack the mottling that is common in the Klej soils, and they have less clay and silt in the subsoil than the Sassafras soils. Galestown soils have a thicker surface layer than Downer soils, and a coarser textured subsoil.

Figure 11.—Sandblasting of vegetable crops can be reduced by protecting them with narrow strips of close-growing crops. The soil is Galestown sand, 0 to 5 percent slopes.

Galestown sand, 0 to 5 percent slopes (GaA).—This soil has the profile described as typical for the series. Included with this soil in mapping are small areas of Klej and Sassafras soils and also small areas of Galestown sand, clayey substratum.

This soil is well suited to irrigated sweet corn, peaches, snap beans, and cantaloupes. The effect of soil blowing can be reduced by the use of windbreaks or cover crops, or by planting narrow strips of close-growing crops (fig. 11). Soluble fertilizers applied as needed compensate for losses though leaching. (Capability unit IVs–7; woodland suitability group 3s1)

Galestown sand, clayey substratum, 0 to 5 percent slopes (GcB).—The clayey substratum of this soil generally is at a depth of 40 to 60 inches, but in places it is only 30 inches from the surface. Otherwise the profile of this soil is similar to that described as typical for the series. Drainage is needed where the clayey substratum is near the surface. Except for drainage, farm use and management are the same as on Galestown sand, 0 to 5 percent slopes. (Capability unit IVs–7; woodland suitability group 3s1)

Holmdel Series

The Holmdel series consists of moderately well drained or somewhat poorly drained loamy and sandy soils. These soils contain small amounts of glauconite, for they generally formed on marine deposits that contain this mineral. They have a moderately high seasonal water table.

In a typical profile the surface layer is dark grayish-brown fine sandy loam about 10 inches thick. The subsoil, about 24 inches thick, is dark-brown mottled sandy clay loam. The underlying material is stratified

dark yellowish-brown and olive-brown loamy sand and sandy loam.

Holmdel soils are moderate or moderately slow in permeability, and they have a moderately high or high available water capacity. Fertility is moderate or moderately high. Where these soils have not been drained, the water table fluctuates. When rainfall is normal, the water table starts to rise in October, reaches its peak late in winter or early in spring, and drops to a depth of more than 5 feet by June. The water table is held up by material that, except in soils having a clayey substratum, generally is at a depth of more than 5 feet. Holmdel soils receive both surface runoff and lateral seepage of ground water from higher soils.

The native vegetation is a forest consisting mostly of red oak, white oak, scarlet oak, yellow-poplar, beech, and hickory. In somewhat poorly drained areas, however, pin oak, willow oak, sweetgum, and southern red oak are dominant. Common shrubs are viburnum and spicebush.

Most areas have been cleared for crops. Grown in adequately drained areas are corn, soybeans, small grains, hay, pasture, fruit, vegetables, and nursery plants.

In most places, farmed Holmdel soils have been drained by open ditches or underdrains. Although drained areas may be saturated in extremely wet periods, these soils drain readily. Added fertilizers do not leach readily, and response to them is good. Except where they have been limed heavily, these soils are very strongly acid.

Typical profile of Holmdel fine sandy loam, 0 to 2 percent slopes, in a cultivated field 1 mile west of Ellisdale:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine granular structure; friable; glauconitic content low; abrupt, smooth boundary; horizon 8 to 12 inches thick.

A2—10 to 14 inches, yellowish-brown (10YR 5/4) fine sandy loam; very weak, medium, subangular blocky structure; very friable; glauconite content low; abrupt, smooth boundary; horizon 0 to 10 inches thick.

B1—14 to 21 inches, dark-brown (7.5YR 4/4) light sandy clay loam; moderate, medium, subangular blocky structure; friable or firm when moist, slightly sticky and plastic when wet, hard when dry; sand grains coated with clay films; glauconite content low; gradual, smooth boundary; horizon 6 to 18 inches thick.

B2t—21 to 34 inches, dark-brown (7.5YR 4/4) sandy clay loam; few, large, distinct mottles of olive gray (5Y 5/2); moderate, medium, subangular blocky structure that has weak platy tendencies; friable when moist, slightly sticky when wet; sand grains coated with clay; glauconite content low; mica common; gradual, smooth boundary; horizon 10 to 20 inches thick.

C—34 to 60 inches, alternating layers of dark yellowish-brown (10YR 4/4) and olive-brown (2.5Y 4/4) loamy sand and sandy loam; loamy sand is single grain and loose; sandy loam is massive and friable, slightly sticky and plastic when wet; content of unweathered glauconite low.

Holmdel soils contain various amounts of rounded quartzose pebbles, but not in abundance in most places. In most places the solum is between 30 and 40 inches thick.

Unplowed soils have a dark A1 horizon about 4 inches thick and a bleached gray A2 horizon about 2 to 4 inches thick. Plowing destroys these two horizons and mixes them with a yellowish-brown A2 horizon that normally extends to a depth of about 14 inches to form the Ap horizon. The Ap horizon ranges from 2.5Y to 10YR in hue.

The B horizon ranges from 2.5Y to 7.5YR in hue and is 4 or 5 in value. Where these soils are moderately well drained, the chroma ranges from 4 to 8. Where these soils are somewhat poorly drained, the B horizon ranges from 2 to 4 in chroma.

The C horizon is clayey in places, and it contains thin sheets of iron oxide in places.

Holmdel soils occur mostly below Freehold soils and above Shrewsbury soils. They can be distinguished by mottling, which is lacking in the Freehold soils, and they are not so gray as the Shrewsbury soils. Holmdel soils are similar to Woodstown soils, except that they contain glauconite and the Woodstown soils do not. Holmdel soils lack the thick, sandy A horizon common to Pemberton soils.

Holmdel fine sandy loam, 0 to 2 percent slopes (HdA).—This soil has the profile described as typical for the series. Included with this soil in mapping are some areas of loamy sandy soils and some Donlonton, Adelphia, and Shrewsbury soils.

Where adequately drained, this soil is suited to general crops, fruits, and vegetables. It needs drainage by either underdrains or open ditches. Even where drained, it may become wet when rainfall is abnormally high. If high-value crops are grown, surface drains, as well as underdrains, may be needed. Ditchbanks should be sloped and seeded to reduce silting. (Capability unit IIw–14; woodland suitability group 2w1)

Holmdel fine sandy loam, 2 to 5 percent slopes (HdB).—This soil has a profile similar to that described as typical for the series. Drainage is the main limitation to use of this soil, but there also is a hazard of erosion.

This soil can be drained by underdrains or by open ditches. In many places interceptor underdrains are efficient in lowering the water table. Ditchbanks should be sloped and seeded to reduce silting.

Erosion can be controlled by stripcropping, using cover crops, or terracing. (Capability unit IIw–14; woodland suitability group 2w1)

Holmdel loamy sand, 0 to 5 percent slopes (HlB).—This soil has a surface layer about 18 inches thick that consists of loose loamy sand, but otherwise its profile is similar to that described as typical for the series. This soil is subject to soil blowing. It warms early in spring and is easily worked. It is only moderately fertile, and it needs more frequent irrigation than the Holmdel fine sandy loams.

Included with this soil in mapping are areas of Freehold and Shrewsbury soils. The Freehold soils are in high positions, and the Shrewsbury soils are in low positions.

This Holmdel soil has a fluctuating water table and needs drainage if it is to be farmed. Deep drainage is effective in lowering the water table. Soil blowing needs to be controlled on extensive exposed areas of this soil.

Where it is adequately drained, this soil is suited to early vegetables and fruit and is somewhat less suited to general farm crops. (Capability unit IIIw–15; woodland suitability group 2w1)

Holmdel fine sandy loam, clayey substratum, 0 to 2

percent slopes (HmA).—This soil has a clay, sandy clay, or clay loam substratum that restricts permeability. The clayey layer generally occurs at a depth of 40 to 60 inches in most places, but it is only 30 inches below the surface in places. Except for this substratum, this soil has a profile similar to that described as typical for the series.

This soil is suited to the same kinds of crops as Holmdel fine sandy loam, 0 to 2 percent slopes, but it is more difficult to drain. Excess water is perched on the clayey substratum when rainfall is heavy and may move laterally over it. Care must be taken to keep underdrain lines above the clayey substratum. When rainfall is heavy, the water table rises more rapidly than in Holmdel fine sandy loam, 0 to 2 percent slopes.

This soil is less suitable for dug ponds than Holmdel fine sandy loam, 0 to 2 percent slopes, because the underlying clayey layer slows recharge rates. Because the clayey layer may cause extreme acidity, this soil also is less suitable for ponds constructed for wildlife. (Capability unit IIw–14; woodland suitability group 2w1)

Holmdel fine sandy loam, clayey substratum, 2 to 5 percent slopes (HmB).—This soil has a clay, sandy clay, or clay loam substratum that restricts permeability. In most places the clayey layer occurs at a depth of 40 to 60 inches, but in places it is only 30 inches below the surface. Permeability of the substratum is slow. Except for the clayey substratum, this soil has a profile similar to that described as typical for the series. It is more susceptible to erosion than Holmdel fine sandy loam, 0 to 2 percent slopes.

Where it is adequately drained, this soil is suited to general crops, fruit, and vegetables. In many places interceptor underdrains are effective in lowering the water table. Ponds dug in this soil are likely to have low recharge rates. (Capability unit IIw–14; woodland suitability group 2w1)

Holmdel-Urban land complex (Hn).—In most places slopes of this complex are 0 to 2 percent. Included with the complex in mapping are areas of Woodstown soils that need the same treatment as Holmdel soils where used for urban development.

Most areas of this complex are in community development. These areas were developed originally on one property at a time, and the soil was not mixed in large areas. More than 50 percent of the mapping unit is estimated to consist of undisturbed Holmdel soils, mostly fine sandy loam. (Capability unclassified; woodland suitability unclassified)

Keansburg Series

The Keansburg series consists of very dark colored, nearly level soils that are very poorly drained and receive much runoff water from the slopes above. These soils developed in water-laid deposits that are mostly marine in origin but that have been redeposited in places. The prominently mottled olive-gray subsoil is moderately coarse textured and contains small to moderate amounts of glauconite. These soils occur at the bottom of large circular depressions and along streams, especially at the headwaters. They are most extensive in soil association 4 (see the general soil map).

In a typical profile the surface layer is very dark gray fine sandy loam about 10 inches thick. The subsoil is olive-gray fine sandy loam that extends to a depth of about 30 inches. The underlying material is stratified dark greenish-gray sand and dark reddish-brown and dark-red sandy loam.

Keansburg soils are moderately permeable and have a moderately high available water capacity. They dry out late in spring and are late in warming. In their normal condition, these soils are saturated 8 to 10 months of the year. Late in winter, water is at the surface or is ponded; in summer it drops to a depth of about 3 feet.

The native vegetation is a hardwood forest that consists mostly of pin oak, willow oak, swamp white oak, red maple, sweetgum, ash, beech, and holly, and there are a few yellow-poplar and southern red oak. The understory is dense and consists of viburnum, spicebush, highbush blueberry, bayberry, and greenbrier. Sweetgum seeds readily in idle fields.

Where adequately drained, these soils are used for soybeans, corn, pasture, hay, small grains, blueberries, and later vegetables. They are not suited to alfalfa and fruit.

Drainage is needed if these soils are to be farmed. The water table can be lowered by either underdrains or ditches. In addition, surface drainage may be needed to prevent loss of small grains and high-value crops. In some places iron-cemented layers just below plow depth may interfere with the construction of drainage ditches. These soils are moderately fertile and are high in organic-matter content. Unless they have been heavily limed, these soils are very strongly acid. Keansburg soils are generally good sites for dug ponds.

Typical profile of Keansburg fine sandy loam in a cultivated field south of Mount Holly-Pemberton Road and west of Buddtown-Birmingham Road:

Ap—0 to 10 inches, very dark gray (10YR 3/1) fine sandy loam; few, fine and medium, distinct mottles of reddish brown (5YR 4/4); weak, fine and medium, granular structure; very friable; abrupt, smooth boundary; horizon 8 to 12 inches thick.

B1g—10 to 15 inches, olive-gray (5Y 4/2) heavy fine sandy loam; common or many, fine to coarse, prominent mottles of dark reddish brown (2.5YR 3/4) in ped interiors; moderate, medium, subangular blocky structure; friable, sticky and plastic when wet; pores common; most sand grains bridged, some coated; common iron concretions as much as 1½ inches in diameter; glauconite content low; gradual, smooth boundary; horizon 0 to 10 inches thick.

B2tg—15 to 30 inches, heavy fine sandy loam that has olive-gray (5Y 4/2) ped exteriors and dark greenish-gray (5GY 4/1) ped interiors; weak, thin, platy structure; partly friable, partly firm, sticky and plastic when wet; some plates weakly to strongly cemented by iron; pores common; sand grains bridged with clay; glauconite content low; abrupt, smooth boundary; horizon 8 to 18 inches thick.

Cg—30 to 60 inches, dark greenish-gray (5GY 4/1) sand layers that have many dark glauconite grains and that alternate with dark reddish-brown (2.5YR 2/4) and dark-red (2.5YR 3/6) sandy loam layers; sand layers are single grain and loose; reddish sandy loam layers are massive, friable, and have

moderate glauconite content; some sandy loam layers are iron cemented.

The solum ranges from 20 to 40 inches in thickness. Rounded quartzose pebbles occur in some places, but normally they are not abundant.

In places the Ap horizon is black or very dark brown loam. In some areas the B horizon is sandy clay loam. Mottling is commonly distinct or prominent.

The C horizon normally consists of stratified sandy layers, but in places there are thin iron-cemented layers, and small areas are underlain by clay beds.

Keansburg soils are associated mostly with Shrewsbury, Adelphia, and Holmdel soils. Keansburg soils have a darker surface layer than Shrewsbury soils and are more gray than Adelphia and Holmdel soils. Keansburg soils resemble Pocomoke soils, except for the olive-gray B horizon and the glauconite that occur in the Keansburg soils.

Keansburg fine sandy loam (Ka).—Included with this soil in mapping are areas of loam or mucky loam, and small areas of loamy sand that are not extensive enough to map separately. The loam cannot be worked so quickly after a rain as the sandier soil. It is also subject to frost heave and possible surface ponding.

In considerable areas of this soil the ironstone has formed at a depth of 10 to 20 inches. Ironstone occurs in less than half of this soil. Where more than half of the area contains ironstone, it is mapped as Shrewsbury, ironstone variant. Where the cemented iron occurs at a depth of 24 inches, it does not affect farming so much as where it occurs at 10 inches. (Capability unit IIIw–25; woodland suitability group 3w2)

Keyport Series

The Keyport series consists of moderately well drained brownish soils that have a moderately fine or fine textured subsoil and that formed on clay beds. The clay beds are thick marine deposits containing variable amounts of glauconite. In many places the material has been redeposited. Slopes are as much as 25 percent in some places, but the nearly level to gently sloping soils in high positions are most extensive.

In a typical profile the surface layer is a dark grayish-brown loam about 10 inches thick. The dark yellowish-brown subsoil extends to a depth of about 38 inches. It is loam in the upper 6 inches and clay loam below, and there is mottling below a depth of 24 inches. The substratum is gray clay loam (fig. 12).

Keyport soils have a high available water capacity and are slowly permeable. When rainfall is heavy and not much water is used, excess water occurs in the surface layer and subsoil and in the sandy loam layers of the substratum where they are present. The water perches over the clayey material but does not saturate the soil. These soils crack widely when they dry, and they crust enough to reduce seed germination.

These soils are moderate in organic-matter content and in fertility. They warm slowly in spring and dry slowly after heavy rains. Because of the high available water capacity and slow permeability, few crops are irrigated. Except where lime has been added in large amounts, these soils are very strongly acid.

The native vegetation is a hardwood forest consisting of yellow-poplar, red oak, white oak, ash, beech, and hickory. The only native stands of rhododendron in the Coastal Plain grow on the abrupt, north-facing slopes of Keyport soils. A small area of Keyport loamy sand in the outer Coastal Plain supports a mixture of pines and oaks.

Figure 12.—Profile of Keyport loam.

In most places Keyport soils have been cleared for crops. The most common crops are small grains, corn, soybeans, hay, pasture, and tomatoes. Drainage is generally not good enough for fruit.

Typical profile of Keyport loam, 0 to 2 percent slopes, in a cultivated field a half mile northwest of Jacksonville:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) loam; moderate, fine, granular structure; friable; glauconite content low; clear, smooth boundary; horizon 8 to 12 inches thick.

B1—10 to 16 inches, dark yellowish-brown (10YR 4/4) heavy loam; moderate, medium, subangular blocky structure; firm when moist, hard when dry, sticky and plastic when wet; thin discontinuous clay films on ped faces; glauconite content low; gradual, smooth boundary; horizon 2 to 8 inches thick.

B2t—16 to 24 inches, dark yellowish-brown (10YR 4/4) heavy clay loam, yellowish brown (10YR 5/8) when crushed; moderate, medium, subangular blocky structure; very firm when moist, very hard when dry, sticky and plastic when wet; thin clay films on ped faces; glauconite content low; gradual, smooth boundary; horizon 8 to 20 inches thick.

B3—24 to 38 inches, dark yellowish-brown (10YR 4/4) clay loam; common, medium, distinct mottles of gray (10YR 5/1); weak, medium, subangular blocky structure; firm when moist, hard when dry, sticky and plastic when wet; thin clay films on ped faces; glauconite content low; gradual, smooth boundary; horizon 8 to 18 inches thick.

C—38 to 60 inches, gray (10YR 5/1) clay loam, dark yellowish brown (10YR 4/4) when crushed; massive; firm when moist, sticky and plastic when wet; glauconite content low; abrupt, smooth boundary.

Keyport soils contain rounded quartzose pebbles and cobblestones in places. They are concentrated in the surface layer, but normally a few are in the horizons below. The solum ranges from 30 to 50 inches in thickness, but plant roots extend into the clayey underlying material.

Unplowed Keyport soils normally have a very dark A1 horizon about 4 inches thick and an A2 horizon of about the same thickness. When the soils are plowed, these horizons are destroyed and mixed with the upper part of the B1 horizon to make an Ap horizon. The Ap horizon is 2 or 3 in chroma.

The B horizon ranges from 10YR to 7.5YR in hue, is 4 or 5 in value, and ranges from 4 to 8 in chroma. It is yellowish brown or strong brown when crushed. In places mottling is more abundant, more prominent, and closer to the surface than in the typical profile. The B2t horizon ranges from heavy clay loam to clay. It has angular blocky structure where texture is fine (heavy) and subangular blocky structure where texture is coarser (light).

In places the C horizon contains 6 to 12 inches of sandy loam over underlying clay loam, silty clay, or clay beds. Water normally is transmitted laterally over the clayey substratum. Thin iron sheets form in the cracks in the clay beds in places. The clay beds also contain numerous nodules of iron pyrite that form sulphuric acid in solution.

Keyport soils are associated mostly with Donlonton, Holmdel, Freehold, Collington, and Sassafras soils. Keyport soils are not so gray as Donlonton soils. They are finer textured in the B horizon than the Holmdel, Freehold, Collington, and Sassafras soils.

Keyport loamy sand, 0 to 5 percent slopes (KeB).—This soil has a light yellowish-brown surface layer 16 inches thick. It is underlain by brownish-yellow (10YR 6/6) sandy clay and light-gray (2.5Y 7/2) clay that extends to a depth of about 5 feet. The upper few inches of the surface layer are bleached gray, as is common in the pine barrens. In other respects the profile of this soil is similar to that described as typical for the series.

This soil is in the outer Coastal Plain. It contains no glauconite, and all areas are forested with pitch pine and oak, as are the adjacent sandy soils. (Capability unit IIe–3; woodland suitability group 2w1)

Keyport fine sandy loam, 2 to 5 percent slopes (KfB).—This soil warms a little earlier in spring than Keyport loam, 0 to 2 percent slopes, and is more easily worked. It has a fine sandy loam surface layer but otherwise has a profile similar to that described as typical for the series.

This soil is suited to late planted vegetables such as tomatoes. On the longer slopes, the use of cover crops and stripcropping may be necessary to control erosion. Drainage is needed only on the ponded, more nearly level areas. Underdrains are satisfactory for draining local sandy pockets. Because the subsoil is so slowly permeable, underdrains generally work too slowly to be effective. (Capability unit IIe–2; woodland suitability group 2w1)

Keyport loam, 0 to 2 percent slopes (KlA).—This soil has the profile described as typical for the series. Included with this soil in mapping are small areas of Holmdel, Collington, and Sassafras soils. Also included are small areas of sandy loam.

Water is ponded in rounded depressions and on extensive flats. Well-spaced, shallow ditches can be used for draining these depressions if they are not too deep. The flats also need a bedding system to help dispose of perched surface water. Except where sandy pockets occur, underdrains generally are ineffective.

Alfalfa, small grains, and other crops that are on the soil through winter may be damaged by frost heave. Alfalfa is not easily grown on this soil; some spots are too wet, and others are severely damaged by frost heave. (Capability unit IIw–1; woodland suitability group 2w1)

Keyport loam, 2 to 5 percent slopes (KlB).—Runoff is moderate on this soil, and erosion is a hazard. This soil has a profile similar to that described as typical for the series. Included with this soil in mapping are small areas of Freehold, Collington, and Sassafras soils.

Stripcropping, contour farming, and cover crops are used to reduce the hazard of erosion. Drainage generally is needed only in small areas. Interceptor drains may be satisfactory in the sandier areas. Diversion terraces may be needed to collect surface runoff and divert it to grassed waterways. (Capability unit IIe–1; woodland suitability group 2w1)

Keyport loam, 5 to 10 percent slopes (KlC).—Runoff is moderately rapid on this soil, and erosion is a severe hazard. In some fields erosion has thinned the surface soil so much that normal plowing exposes the more yellow and more sticky subsoil. Except for the thinner surface layer, this soil has a profile similar to that described as typical for the series. Seeps occur on the lower part of long slopes.

Stripcropping, diversion terraces, and contour farming are used to reduce erosion in fields. Interceptor underdrains may be used to collect ground water in places. (Capability unit IIIe–1; woodland suitability group 2w1)

Keyport loam, 10 to 15 percent slopes (KlD).—Runoff is rapid, and erosion is a severe hazard on this soil. Eroded spots are common in fields. Except in the eroded spots, the profile of this soil is similar to that described as typical for the series. Included with this soil in mapping are some severely eroded areas of Keyport loam, 5 to 10 percent slopes.

Keyport loam, 10 to 15 percent slopes, is suited to small grain, hay, and pasture. Germination of seeds and growth of crops are slower on the eroded areas than on the uneroded areas. (Capability unit VIe–1; woodland suitability group 2w1)

Keyport loam, 15 to 25 percent slopes (KlE).—The surface layer of this soil is thinner than that in the profile described as typical for the Keyport series. Seeps occur on the lower parts of long slopes. Included with this soil in mapping are small areas of severely eroded soil that have slopes of 10 to 15 percent.

Because of the erosion hazard, a permanent cover is needed to keep erosion at a minimum. The cover may be pasture, trees, or plantings that provide food and

cover for wildlife. (Capability unit VIIe-1; woodland suitability group 2r1)

Klej Series

The Klej series consists of deep, nearly level and gently sloping sandy soils that have a fluctuating water table that is moderately high late in winter. These soils are moderately well drained or somewhat poorly drained. Unlike most sandy soils in the county, they have almost as much clay in the surface layer as in the underlying layer. These soils form on terraces adjacent to the Delaware River and in the outer Coastal Plain.

In a typical profile the surface layer is dark grayish-brown sand about 10 inches thick. The next layer is light olive-brown sand about 10 inches thick. The underlying material is light yellowish-brown sand mottled with light gray over pale-yellow sand.

These soils are rapid or moderately rapid in permeability, and they have a low available water capacity. They are low in organic-matter content and fertility. But fertility is not so low on the river terraces as it is in the outer Coastal Plain, and added fertilizers do not leach so readily.

When rainfall is normal, the water table starts to rise in September or October, rises to about 2 feet from the surface late in winter or early in spring, and falls below a depth of 5 feet by June. Only deep-rooted plants benefit from the water table in summer when water is needed most. Klej soils are very strongly acid. Additions of lime are needed at frequent intervals because the lime leaches readily.

The native vegetation on river terraces is a hardwood forest that consists mostly of black oak, white oak, and hickory. In the outer Coastal Plain, pines make up much of the forest. The kind of forest depends mainly on the frequency and intensity of wildfires.

On the river terraces, Klej soils have been mostly cleared for crops. Sweet corn and peaches are grown on about 90 percent of the farmed terraces. In the outer Coastal Plain only a small acreage of Klej soils has been cleared for crops. The farmed acreage is used mostly for sweet corn, sweetpotatoes, pumpkins, and cantaloups.

Because leaching is rapid, raising the fertility level in these soils is difficult. Additions of fertilizer should be applied often and in small amounts to avoid severe losses from leaching. The soils warm early in spring, and they can be worked directly after heavy rains. The surface layer is loose and subject to soil blowing. In places sandblasting severely damages small plants. Vegetables, such as peppers and tomatoes, are sometimes scalded by the intense heat reflected from the sands.

Typical profile of Klej sand, 0 to 4 percent slopes, in a cultivated field about 1 mile south-southeast of Dellette, adjacent to Atsion Road:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) sand; very weak, fine, granular structure; very friable, nonsticky; roots abundant; less than 1 percent rounded quartzose pebbles; abrupt, smooth boundary; horizon 7 to 12 inches thick.

AC—10 to 20 inches, light olive-brown (2.5Y 5/4) sand; single grain; loose, nonsticky; common roots; few spheroidal concretions one-quarter inch in diameter; clear, smooth boundary; horizon 6 to 15 inches thick.

C1—20 to 32 inches, light yellowish-brown (2.5Y 6/4) sand; common, medium and coarse, light-gray (2.5Y 7/2) mottles; single grain; loose, nonsticky; roots few; gradual, wavy boundary.

C2—32 to 60 inches, pale-yellow (2.5Y 7/4) sand; single grain; loose, nonsticky; less than 1 percent rounded quartzose pebbles less than 1 inch in diameter; roots few.

Klej soils contain varying amounts of rounded quartzose pebbles. In places within a mile of the Delaware River, pebbles and cobblestones form a thick bed below a depth of 3 feet. Much of this area has been developed for residential, commercial, or industrial use.

Klej soils in wooded areas normally have a very dark A1 horizon about 1 or 2 inches thick. Under the A1 horizon a bleached gray horizon has an average thickness of 3 inches but is as much as 6 inches thick in places. When plowed these two horizons are destroyed and mixed with the AC horizon to form the Ap horizon. The Ap horizon is 2.5Y or 10YR in hue and sand or fine sand in texture. The fine sand is dominant on the river terraces but also occurs in the outer Coastal Plain in places.

The AC horizon ranges from 2.5Y to 10YR in hue, is 5 or 6 in value, and ranges from 2 to 6 in chroma. Low chromas occur as mottles or as matrix colors in somewhat poorly drained areas. Texture is sand or fine sand.

The C horizon is 2.5Y or 10YR in hue, ranges from 5 to 7 in value, and from 2 to 6 in chroma. Mottles generally are faint or distinct and few to common. Texture is generally sand or fine sand, but in places it ranges from sandy loam to sandy clay. The most extensive areas of finer textured C horizons were mapped as loamy substratum soils.

Klej soils occur with the Galestown, Evesboro, Downer, Lakewood, and Atsion soils. The mottles in the Klej soils distinguish them from the Evesboro, Downer, and Lakewood soils. Klej soils are not so gray as the Atsion soils and lack the dark-brown B2h horizon that occurs in those soils.

Klej sand, 0 to 4 percent slopes (KmA).—This soil occurs mostly in the outer Coastal Plain where the sands are mostly medium and coarse. Small areas along Rancocas Creek are subject to flooding when that stream rises to its highest levels; they are flooded only during severe floods. This soil has the profile described as typical for the series. Included with this soil in mapping are areas of Klej loamy sand and of Evesboro, Downer, and Lakewood soils.

Widely spaced ditches or underdrains are used to lower the water table enough so that it does not affect crops or vehicles traveling on this soil. Where extensive areas are exposed to long wind sweeps, this soil needs protection against soil blowing. Cover crops, windbreaks, or windstripping can be used for this purpose. (Capability unit IIIw-16; woodland suitability group 3s1)

Klej sand, loamy substratum, 0 to 2 percent slopes (KnA).—This soil has a loamy substratum that is normally at a depth of 40 to 60 inches but that is only 30 inches below the surface in places. In most places this substratum is sandy clay loam, but it ranges from sandy loam to sandy clay. Although the finer textures have an increased available water capacity, this benefits only the deep-rooted plants. Except for the substratum, this soil has a profile similar to that described as typical for the series.

Where the substratum is sandy clay loam or sandy

clay, underdrains should be laid above the substratum. Recharge of ground water is slow in dug ponds. (Capability unit IIIw–16; woodland suitability group 3s1)

Klej fine sand, 0 to 2 percent slopes (KoA).—Except that this soil has a higher percentage of fine sand, at least to a depth of 30 to 40 inches, its profile is similar to that described as typical for the series. These fine sands are unstable. If excavations are made in them, they flow more readily than the medium and coarse sands. The available water capacity and fertility are slightly higher in this soil than in Klej sand, 0 to 4 percent slopes. In addition, this soil has a weakly developed subsoil that has 3 to 5 percent more clay than the surface layer. This additional clay slows leaching of fertilizers somewhat.

Included with this soil in mapping are small areas of Galestown sand and Evesboro fine sand.

Widely spaced open ditches or underdrains keep the water table down where it does not interfere with farming. Maintenance of ditchbanks is more costly than on Klej sand, 0 to 4 percent slopes, and the soil is more subject to soil blowing. (Capability unit IIIw–16; woodland suitability group 3s1)

Kresson Series

The Kresson series consists of somewhat poorly drained soils that contain large amounts of glauconite because they formed in marine deposits containing large amounts of glauconite.

In a typical profile the surface layer is about 8 inches thick and consists of olive-gray fine sandy loam mottled with yellowish brown. The subsoil extends to a depth of 36 inches and is dark olive gray mottled with dark yellowish brown. It is sandy clay in the upper 12 inches and sandy clay loam below. The substratum is stratified olive-gray and dark yellowish-brown sandy loam and sandy clay loam.

The permeability is slow in the subsoil and moderately slow in the surface layer and substratum when the soil is moist and the clays are swelled. Permeability is more rapid in summer when the clay contracts and the soil cracks. The available water capacity is high. Although excess water is perched over the sandy clay subsoil for some time after heavy rains, the soils do not become completely saturated. When rainfall is normal, undrained Kresson soils have ground water in the substratum from October to May, and excess water may be perched over the subsoil in the same period.

These soils are high in natural fertility, and added fertilizers do not leach readily. Kresson soils are generally very strongly acid, and large additions of lime are needed to correct this condition. In places, the substratum is only slightly acid or nearly neutral. Organic-matter content is low in the loamy sand and is moderate in the loam and fine sandy loam.

The native vegetation is a hardwood forest consisting of mostly oak, hickory, beech, ash, redcedar, and Virginia pine. Virginia pine or redcedar normally seed in idle areas.

Kresson soils are well suited to general crops. The loamy sand is used mostly for vegetables, corn, soybeans, small grains, hay, and pasture. The loamy sand warms early and is easily worked, but it is subject to soil blowing. The Kresson fine sandy loam and loam soils are difficult to work, because the period of optimum moisture is so short. They are either too wet or too dry most of the time.

Only a very small acreage of the Kresson soils is irrigated. When rainfall is normal, deep drainage and surface drainage are needed. The ground water can be lowered by use of open ditches or underdrains. Because of the clayey subsoil, underdrains alone cannot drain off the surface waters fast enough. These soils are only moderately suitable for dug ponds.

Typical profile of Kresson fine sandy loam, 0 to 3 percent slopes, in a cultivated field one-eighth mile north of Evesboro:

Ap—0 to 8 inches, olive-gray (5Y 4/2) fine sandy loam; few, fine, prominent mottles of yellowish brown (10YR 5/8); moderate, medium, granular structure; friable, sticky and plastic when wet; glauconite content medium to high; 3 to 5 percent rounded quartzose pebbles as much as 2 inches in diameter; abrupt, smooth boundary; horizon 6 to 12 inches thick.

B21t—8 to 20 inches, dark olive-gray (5Y 3/2) sandy clay, dark olive (5Y 3/3) when crushed; many, fine, distinct mottles of dark yellowish brown (10YR 4/4); moderate to strong, coarse, angular blocky structure; very firm when moist, very hard when dry, very sticky and plastic when wet; distinct clay films on ped faces; glauconite content more than 40 percent; gradual, smooth boundary; horizon 10 to 24 inches thick.

B22t—20 to 36 inches, dark olive-gray (5Y 3/2) sandy clay loam, dark olive (5Y 3/3) when crushed; many, fine to medium, distinct mottles of dark yellowish brown (10YR 4/4); moderate, coarse and medium, subangular blocky structure; firm to friable when moist, hard when dry, sticky and plastic when wet; discontinuous thin clay films on ped faces; glauconite content high; abrupt, smooth boundary; horizon 10 to 20 inches thick.

C—36 to 60 inches, alternating layers of olive gray (5Y 4/2) and dark yellowish brown (10YR 4/4) sandy loam and sandy clay loam; many, medium, prominent mottles; massive; friable when moist, sticky and plastic when wet; unweathered glauconite content high; glauconite adds dark grains to mass color; lower brown layer is commonly iron cemented.

Kresson soils contain varying, but generally not large, amounts of quartzose gravel.

Unplowed Kresson soils have a very dark A1 horizon about 4 inches thick. When they are plowed, this horizon is mixed with the horizon below to form the Ap horizon. Kresson soils tend to have a darker Ap horizon than other soils of the county that have the same natural drainage. The Ap horizon is 5Y or 2.5Y in hue and 3 or 4 in value. Textures are loam, fine sandy loam, and loamy sand.

The B horizon is mostly 5Y in hue, but in places it is 2.5Y. It is 3 or 4 in value and ranges from 2 to more than 4 in chroma. Mottles are generally prominent. They are 10YR or 5YR in hue, 4 or 5 in value, and range from 4 to 8 in chroma. Mottles range from common to many and are generally fine or medium. In most places the B horizon is mainly sandy clay, but commonly it is sandy clay loam in some part. Structure is generally blocky or angular blocky, but it tends to be prismatic.

Most strata of the C horizon are friable and appear porous. All are highly glauconitic, and when they become wet, the clays swell and are slowly permeable. In many places iron sheets prevent normal movement of water downward.

Kresson soils are associated mainly with Marlton, Colemantown, and Adelphia soils. They are more gray than

Marlton soils and have mottling closer to the surface. Kresson soils are not so gray as Colemantown soils and are not so sandy or so brown as Adelphia soils.

Kresson loamy sand, 0 to 3 percent slopes (KwA).—This soil is not extensive. It occurs north of Medford and north of Cookstown along the Burlington-Ocean County line. The loamy sand surface layer averages about 16 inches in thickness and apparently is a wind deposit. Included with this soil in mapping are small areas of Marlton soils.

This soil warms earlier in spring than Kresson fine sandy loam and Kresson loam, and it is better suited to vegetables.

Water is absorbed readily by the loamy sand surface layer, but it is not transmitted readily through the sandy clay subsoil. As a consequence, the water is perched over the subsoil for long periods and surface drainage is needed. Also needed is protection from soil blowing by the use of windbreaks, cover crops, or windstripping. (Capability unit IIIw-12; woodland suitability group 2w1)

Kresson fine sandy loam, 0 to 3 percent slopes (KxA).—Most of this soil is nearly level and receives runoff from the slopes above. It has the profile described as typical for the series. Included with this soil in mapping are small areas of Kresson loam, and small areas of Marlton, Colemantown, and Adelphia soils, especially the glauconitic variant.

This Kresson soil is well suited to general crops and tomatoes. It drains slowly and warms late. Surface drainage is needed on this soil, and subsurface drainage may be needed in places. (Capability unit IIIw-12; woodland suitability group 2w1)

Kresson loam, 0 to 3 percent slopes (KyA).—This soil is hard to work because it is too wet or too dry much of the time. It is slower to warm in spring and more difficult to work than Kresson loamy sand and Kresson fine sandy loam. It is also less well suited to vegetables. This soil has a loam surface layer, but otherwise its profile is similar to that described as typical for the series. Included with this soil in mapping are small areas of clay loam.

This Kresson loam is well suited to hay, pasture, small grains, corn, and soybeans, though cultivation should be limited. Surface drainage is needed, and subsurface drainage is also needed in some places. (Capability unit IIIw-11; woodland suitability group 2w1)

Lakehurst Series

The Lakehurst series consists of deep, loose, moderately well or somewhat poorly drained sandy soils that have a bleached horizon 7 or more inches thick. Slopes range from 0 to 5 percent. These soils formed in coarse water-laid deposits on the outer Coastal Plain. They are the most extensive soils of Burlington County.

In a typical profile the surface layer is gray sand about 3 inches thick. The subsurface layer is light-gray sand about 12 inches thick. The subsoil, about 25 inches thick, is dark-brown loamy sand in the upper 3 inches and yellowish-brown sand mottled with grayish brown below. The substratum is pale-brown sand.

Figure 13.—A special crop of beachgrass produced on Lakehurst soil for replanting on the coastal beaches.

Lakehurst soils are very strongly acid and very low in natural fertility. Added fertilizers leach readily. The content of organic matter is very low. Because these soils are loose, they are subject to soil blowing and, on slopes, to water erosion. The fluctuating water table in these soils starts to rise in about October, rises to about 2 feet from the surface by late in winter or early in spring, and drops shortly after spring. Since plants use more water in summer than in other seasons, this water table is of value only to deep-rooted plants. Lakehurst soils have rapid or moderately rapid permeability and a low or very low available water capacity. They can be readily drained by widely spaced ditches or underdrains.

The natural vegetation is mostly pitch pine mixed with black and white oak, blackgum, and hickory trees. The understory includes lowbush blueberries, gallberries, and scattered sheep laurel. The sheep laurel generally has roots deep enough to reach the water table (*8*). Where wildfires have been severe, there are few hardwoods except scrub oak and blackjack oak. Where wildfires have been extremely severe, the trees are dwarfed to a height of about 4 to 6 feet regardless of age (*2*).

A considerable acreage of Lakehurst soils was cleared and cultivated about a hundred years ago, but little of this is now cultivated (fig. 13). Some areas recently have been cleared for planting to blueberries, but these soils are too low in fertility and too dry for this crop.

Where wildfires can be eliminated, trees can be grown for pulpwood on Lakehurst soils. Deer eat a large amount of acorns from scrub oak, and the Fish and Game Commission has cleared some areas and planted them to vegetation that supplies food for deer.

Typical profile of Lakehurst sand, 0 to 3 percent slopes, in a wooded area at Scout Camp Lenape near Medford:

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A1—0 to 3 inches, gray (10YR 5/1) sand; single grain; loose; abundant fine roots; clear, smooth boundary; horizon 0 to 4 inches thick.

A2—3 to 15 inches, light-gray (10YR 6/1) sand; single grain; loose; abrupt, irregular boundary; few white quartz pebbles; horizon 6 to 24 inches thick.

B2h—15 to 18 inches, dark-brown (7.5YR 4/2) loamy sand; single grain; about 25 percent, by volume, is firm, irregularly shaped nodules as much as 2 inches in diameter; abrupt, smooth boundary; horizon 0 to 4 inches thick.

B3—18 to 40 inches, yellowish-brown (10YR 5/6) sand; common, medium, faint mottles of grayish brown (10YR 5/2); single grain; loose; about 50 percent of upper 2 inches, by volume, is firm nodules; gradual, smooth boundary; horizon 10 to 22 inches thick.

C—40 to 60 inches, pale-brown (10YR 6/3) sand; single grain; loose.

The A1 horizon ranges from 3 to 5 in value. Where Lakehurst soils are plowed, this horizon is mixed with the A2 to form an Ap horizon, which generally is gray (10YR 5/1).

The A2 horizon generally is gray or light gray, but in a few places it is pinkish gray. It is 5YR to 10YR in hue, 5 or 6 in value, and 1 or 2 in chroma. The lower boundary is wavy or irregular in places, and deep tongues from the A2 horizon extend downward and appear to have formed adjacent to roots or in root channels.

In the B2h horizon the nodules range from none to abundant and from firm to extremely firm. This horizon ranges from 5YR to 10YR in hue, from 2 to 5 in value, and from 2 to 8 in chroma. Texture is sand or loamy sand. In places this horizon is absent.

The B3 horizon has few or common mottles. Its color is 5 or 6 in value and ranges from 3 to 6 in chroma.

In the loamy substratum phases at a depth of 40 to 60 inches, the C horizon generally is sandy loam or sandy clay loam but it is clay or sandy clay in a few places. Layers adjacent to the loamy strata are low in chroma in some places.

The amount of quartzose gravel in Lakehurst soils varies from place to place and in location in the profile. This gravel ordinarily is most abundant where Lakehurst soils occur below the Woodmansie soils. In the profile, the gravel tends to be most abundant in the C horizon.

Lakehurst soils normally occur below Lakewood or Woodmansie soils and above Atsion soils. Mottles in the Lakehurst soils distinguish them from the Lakewood soils, which are not mottled. Lakehurst soils lack the sandy loam B2 horizon that occurs in the Woodmansie soil and are not so gray in the B3 horizon as the Atsion soils.

Lakehurst sand, 0 to 3 percent slopes (LaA).—This soil has the profile described as typical for the series. Included with this soil in mapping are narrow areas with slopes greater than 3 percent. Also included are areas of Lakehurst sand, thick surface, 0 to 3 percent slopes. In some included areas, especially where this Lakehurst sand lies below Woodmansie soils, the subsoil is sandy loam. Apparently, finer textured material washed downslope from the Woodmansie soils. Small areas of Lakewood, Woodmansie, and Atsion soils are included.

Lakehurst sand is too low in fertility and too droughty for crops or pasture. Wildfires must be eliminated if trees suitable for pulpwood are to grow. This soil is often used for camping where it is near water. The water table can be lowered by drainage in most places. (Capability unit IVw–17; woodland suitability group 4s1)

Lakehurst sand, thick surface, 0 to 3 percent slopes (LlA).—This soil has a bleached surface layer averaging 15 inches and ranging from 12 to 24 inches in thickness; otherwise its profile is similar to that described as typical for the series. This thick layer is leached of minerals and therefore is not fertile (fig. 14).

Figure 14.—Profile of Lakehurst sand, thick surface, 0 to 3 percent slopes, showing a thick, bleached surface layer and wavy lower boundary.

On this soil forest stands are not dense. Wildfires must be eliminated if trees are to be grown for pulpwood.

Drainage generally is possible on this soil. Lawns and ornamental plantings are extremely difficult to establish and maintain. Intensive fertilization and watering are needed. Where basements are built, underdrains should be installed. (Capability unit IVw–17; woodland suitability group 4s1)

Lakehurst sand, loamy substratum, 0 to 3 percent slopes (LmA).—This soil has a sandy loam or sandy clay loam layer that generally is at a depth of 40 to 60 inches but that is at a depth of only 30 inches in some places. Otherwise, the profile of this soil is similar to that described as typical for the series. Included with this soil in mapping are a few areas where the substratum is sandy clay or clay. (Capability unit IVw–17; woodland suitability group 4s1)

Lakehurst fine sand, 0 to 3 percent slopes (LnA).—The fine sand surface layer of this soil extends to a depth of at least 30 inches. Otherwise the profile is similar to that described as typical for the series. This fine sand has a low shear strength. When saturated, it flows readily. Ditches dug in it tend to collapse. If this soil is used for growing trees for pulpwood, wildfires

must be eliminated. (Capability unit IVw–17; woodland group 4s1)

Lakehurst fine sand, loamy substratum, 0 to 3 percent slopes (LoA).—The surface layer is fine sand, and loamy layers occur in the substratum. Otherwise, this soil has a profile similar to that described as typical for the series. The loamy layers are generally sandy loam or sandy clay loam, and they normally occur below a depth of 40 inches. Included with this soil in mapping are a few areas where the substratum is clay or sandy clay.

The water table fluctuates more erratically in this soil than in Lakehurst sand, 0 to 3 percent slopes, and artificial drainage is more difficult. Because the fine sands flow readily where saturated, banks of ditches collapse. (Capability unit IVw–17; woodland suitability group 4s1)

Lakehurst-Lakewood sands, 0 to 5 percent slopes (LrA).—This complex contains Lakehurst sand and Lakewood sand that are so intermingled that they could not be shown separately on the soil map. The Lakehurst soil makes up about 60 to 70 percent of the complex in most places, and the Lakewood soil makes up most of the rest. Each of these soils has a profile similar to that described as typical for its series. The Lakewood soil is higher than the Lakehurst.

Enough Lakewood soil occurs in places for homesites and septic fields to be built on it so that the fluctuating water table of the Lakehurst is avoided. Onsite investigations are essential for determining the suitability of these soils for homesites and septic fields. Also essential is the elimination of wildfires if these soils are used as homesites or for growing trees for pulpwood. (Capability unit IVw–17; woodland suitability group 4s1)

Lakehurst-Lakewood sands, loamy substratum, 0 to 5 percent slopes (LsA).—These soils have loamy layers normally below a depth of 40 inches, but except for this they have a profile similar to that described as typical for their respective series. These layers are sandy loam or sandy clay loam in most places. The Lakehurst soil makes up about 60 to 70 percent of this complex, and the Lakewood soil makes up the rest. The Lakewood soil is higher than the Lakehurst.

Because the water table fluctuates more erratically in this complex than in Lakehurst sand, 0 to 3 percent slopes, artificial drainage is more difficult. Septic fields must be designed and installed with care. Enough Lakewood soil occurs in places for homesites and septic tank filter fields to be built on it, and the fluctuating water table of the Lakehurst soil is thus avoided. Onsite investigations are needed to determine the suitability of this complex for homesites and septic fields.

Wildfires must be eliminated where this complex is used as homesites or for growing trees for pulpwood. (Capability unit IVw–17; woodland suitability group 4s1)

Lakewood Series

The Lakewood series consists of deep, loose excessively drained soils that have a bleached horizon 7 or more inches thick. These soils are mainly gently sloping, but slopes are as much as 15 percent in some places. These soils formed in stratified water-laid deposits in the outer Coastal Plain.

In a typical profile of a forested Lakewood soil, the surface layer is gray sand about 10 inches thick. The subsoil is sand that extends to a depth of about 20 inches and is strong brown in the upper 4 inches and brownish yellow below, becoming paler as depth increases. The substratum is light yellowish-brown sand.

Lakewood soils have rapid or moderately rapid permeability and low or very low available water capacity. They are low in organic-matter content and fertility. Added fertilizers leach readily. These soils are very strongly acid. They are subject to soil blowing.

The native vegetation is a forest consisting of pitch pine, black oak, and white oak (fig. 15). Where wildfires have been severe, the vegetation has reverted to pitch pine, scrub oak, and blackjack oak. Where wildfires have been most severe, the trees are dwarfed; they grow less than 5 feet high, though they are 50 or more years old.

Several thousand acres of these soils originally were cleared for farming, but nearly all of this acreage has reverted to woodland. Crop yields were so low that cultivation was abandoned. Irrigation was not available when this land was farmed, and few crops could be grown even with modern methods. Lakewood soils are so low in fertility that many grasses and legumes commonly grown on the more fertile soils will not survive. Weeping lovegrass and tall fescue have been successful in places.

Typical profile of Lakewood sand, 0 to 5 percent slopes, in a forest 3 miles north of Green Bank:

A2—0 to 10 inches, gray (10YR 6/1) sand; single grain; loose; abrupt, wavy boundary; horizon 6 to 24 inches thick.

B2—10 to 14 inches, strong-brown (7.5YR 5/8) sand; single grain; loose; abrupt, wavy boundary; horizon 0 to 8 inches thick.

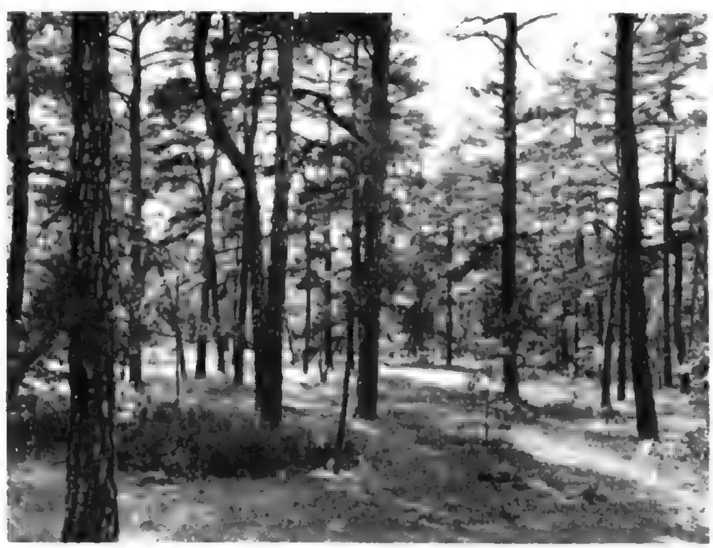

Figure 15.—**Mature open stand of pine on a Lakewood sand where there has been no recent wildfire damage.**

B3—14 to 20 inches, brownish-yellow (10YR 6/6) sand; single grain; large roots concentrated in this horizon; common spheroidal nodules as much as one-eighth inch in diameter; gradual, wavy boundary; horizon 6 to 20 inches thick.

C—20 to 60 inches, light yellowish-brown (10YR 6/4) sand; single grain; nodules diminish in number with depth.

In places Lakewood soils contain rounded quartzose pebbles, but generally not in large amounts. In places they have a dark or very dark A1 horizon that is as much as 4 inches thick. This horizon is missing in many places, and where the soils are cultivated, this horizon is destroyed.

In places Lakewood soils have a discontinuous dark brown or very dark brown horizon about 1 to 4 inches thick in the upper part of the B horizon. This horizon is present in less than 25 percent of the acreage. It ranges from 5YR to 10YR in hue, from 3 to 5 in value, and from 2 to 8 in chroma. In places it contains a few iron concretions. The lower part of the B horizon ranges from 2.5Y to 10YR in hue, is 5 or 6 in value, and ranges from 4 to 6 in chroma.

The C horizon ranges from 4 to 6 in value and from 4 to 8 in chroma. Where there are underlying loamy layers, adjacent layers are as low as 1 in chroma.

Lakewood soils are associated mostly with Lakehurst, Evesboro, Woodmansie, and Klej soils. Lakewood soils lack the mottling common to Lakehurst and Klej soils and the sandy loam subsoil common to Woodmansie soils. Lakewood soils are more deeply bleached than Evesboro soils.

Lakewood sand, 0 to 5 percent slopes (LtB).—This soil is so rapidly permeable that runoff occurs only during intensive rainfall. It has the profile described as typical for the series. Included with this soil in mapping are small areas of Lakehurst, Woodmansie, and Evesboro soils. The Lakehurst soils are in low positions. Also included are small areas that have slopes of more than 5 percent, areas that have a loamy substratum, and areas of fine sand.

Most of this soil is in woodland. Scrub oak provides food for the deerherd in fall. Protection from wildfires is the greatest management need if this soil is to provide trees for pulpwood. The trees also increase the amount of rainfall that becomes ground water. (Capability unit VIIs–8; woodland suitability group 5s1)

Lakewood sand, 5 to 10 percent slopes (LtC).—Because runoff is moderate and the sand is loose, erosion is likely where this soil is without cover. Included with this soil in mapping are small areas of Woodmansie, Evesboro, and Downer soils. (Capability unit VIIs–8; woodland suitability group 5s1)

Lakewood sand, 10 to 15 percent slopes (LtD).—On this soil, most slopes are short and runoff is rapid. Because of this runoff and because the sand is loose, erosion is severe where this soil is bare. A permanent vegetative cover is needed to keep erosion and deposition at a minimum. (Capability unit VIIs–8; woodland suitability group 5s1)

Lakewood sand, thick surface, 0 to 5 percent slopes (LuB).—This soil is extremely low in fertility and available water capacity. It has a bleached horizon that ranges from 12 to 20 inches in thickness, but average thickness is 15 inches. Except that it has a thicker surface layer, the profile of this soil is similar to that described as typical for the series.

The low fertility of this soil is reflected by the very low density in the forest stand. Where this soil is used for lawns or landscape plants, intense fertilization and watering are needed. (Capability unit VIIs–8; woodland suitability group 5s1)

Lakewood sand, loamy substratum, 0 to 5 percent slopes (LvB).—This soil has sandy loam or sandy clay loam layers mostly at a depth of 40 to 60 inches, but in places at 30 inches. Otherwise this soil has a profile similar to that described as typical for the series.

Because of the finer substratum layers, this soil has more water that is available to deep-rooted trees. (Capability unit VIIs–8; woodland suitability group 5s1)

Lakewood fine sand, 0 to 5 percent slopes (LwB).—Except for the fine sand surface layer that extends to a depth of 30 inches in most places, this soil has a profile similar to that described as typical for the series. This soil has a higher available water capacity than Lakewood sand, 0 to 5 percent slopes. Shear strength and stability are lower, because of the more uniform size of the sand. (Capability unit VIIs–8; woodland suitability group 5s1)

Lakewood fine sand, loamy substratum, 0 to 5 percent slopes (LyA).—This soil has a fine sand surface layer that extends to a depth of 30 to 40 inches and has sandy loam or sandy clay loam layers in the substratum. The fine sand has low shear strength and stability. Otherwise its profile is similar to that described as typical for the series. (Capability unit VIIs–8; woodland suitability group 5s1)

Made Land

Three units of Made land have been mapped—Made land, dredged coarse material; Made land, dredged fine material; and Made land, sanitary fill.

Made land, dredged coarse material (Ma).—This is mostly coarse material dredged from the Delaware River or the Bass River and pumped into diked areas beside the rivers to settle. Boulders, cobblestones, and pebbles settle in this material (fig. 16). Fine material settles in the most distant parts of the ponded area,

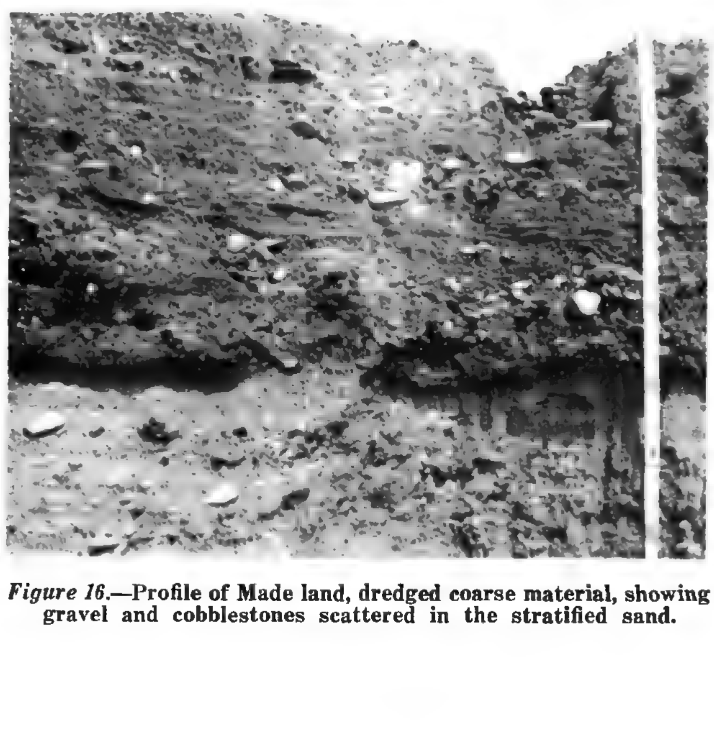

Figure 16.—**Profile of Made land, dredged coarse material, showing gravel and cobblestones scattered in the stratified sand.**

and sands occupy most of the area between the fine material and the boulders, cobblestones, and pebbles. The deposits are 5 to 20 feet thick along the Delaware River and 3 to 8 feet thick along the Bass River.

In the Palmyra area, Made land is very sandy and extremely low in fertility. After the dredged material was deposited, the area remained bare for a long time. It was subject to severe soil blowing until it was limed, fertilized, seeded, and tied down with stakes and twine. It was seeded with tall fescue, which provided an excellent cover.

On Hawk Island at Riverside, the dredged material contains large amounts of mica, probably from the Wissahickon schist at the bottom of the river. The material includes enough fines to make revegetation possible. Many perennial weeds, river birch, sycamore, black locust, red maple, boxelder, and willow invade readily. In this area, the material is being dredged again as a source of sand and gravel.

South of New Gretna, adjacent to the Bass River, are several areas of gravel, sand, silt, and clay. These areas are mostly sand, but they contain more silts than the Made land along the Delaware River.

This Made land is rapidly permeable and subject to severe soil blowing. Runoff is low and fertility is very low. Perennial grasses can be seeded to reduce soil blowing. Made land, dredged coarse material, is used primarily as a receiving area for dredging operations needed to keep the river channels open. In some areas the material is used as fill or as a source of gravel and sand. Some areas are used as sites for sanitary land fills.

Made land, dredged coarse material, is not suited to crops. Because of the high population along the Delaware River, it is not used for wildlife habitats. Some sites have been developed for industry; others have a potential for port and marine development. (Capability and woodland suitability unclassified)

Made land, dredged fine material (Mf).—This land type consists mostly of fine material dredged from the Delaware River and pumped into diked areas. The source of this material is mostly the thick clay beds of the Magothy Formation. Deposits are 10 to 20 feet thick. Thin sandy layers are mixed with the clay in places. Boulders, cobbles, pebbles, and sand generally are in the discharge area. The pumped silts and clays normally are held in suspension for some time before they settle, but where clay beds are dredged from the river bottom, the clay also comes out of the pipe as partly rounded masses 2 to 10 inches in diameter (fig. 17). In summer the clay cracks severely as it dries. Permeability is slow; runoff is high.

This land is not suitable for crops. It is used primarily for industrial development. Where large areas such as parking lots are to be paved, a permeable subbase is needed. (Capability and woodland suitability unclassified)

Made land, sanitary fill (Mg).—This land type consists of areas used for rubbish disposal and then covered by soil. Normally a series of trenches are dug, and rubbish, including garbage, metal, glass, wood, building foundation materials, industrial wastes, and many other materials, is dumped into them. As the

***Figure 17.—Top,* dredge discharge area and cone of partly rounded clay masses; *bottom,* partly rounded clay masses at the discharge area.**

trenches are filled, the refuse is covered by the excavated soil. Land fills are subject to uneven settling and the formation of hydrogen sulfide as the organic material decays. Some fill areas are formed by filling low wetlands.

Some sanitary land fills are designed to be used again for land fills after allowing time for decomposition of the rubbish. Some areas have been converted to parks. Limitations are severe for use of the areas for crops, woodland, septic tank disposal fields, or building sites. Limitations are moderate for use of the area for wildlife habitats. (Capability and woodland suitability unclassified)

Marlton Series

The Marlton series consists of nearly level to sloping, moderately well drained and well drained soils that contain large amounts of glauconite. These soils occur in high positions. They formed in marine depos-

its that contain large amounts of glauconite.

In a typical profile the surface layer is dark olive-gray fine sandy loam about 10 inches thick. The subsoil extends to a depth of about 40 inches. It is dark-olive sandy clay in the upper 20 inches and olive-brown and dark olive-gray clay loam below. The underlying material is stratified dark olive-gray and olive-brown sandy loam and sandy clay loam.

When these soils are moist and the clays are swelled, permeability is moderately slow in the surface layer, slow in the subsoil, and moderately slow in the substratum. Permeability is more rapid in summer when the soils crack from shrinking. These soils have a high available water capacity. They never become completely saturated. Excess water is perched over the sandy clay subsoil for some time after heavy rains. Shrink-well properties are moderate. These soils are moderate in organic-matter content and high in fertility.

Drainage of these Marlton soils generally is not practical. Because they warm late in spring and dry slowly after rains, these soils are not easily worked. They are sometimes called "Sunday" soils—too wet to work on Saturday and too dry on Monday. The period of optimum moisture content for plowing and cultivating is short. These soils tend to be sticky when wet and very firm when dry. Because Marlton soils are very strongly acid, they need large additions of lime. At depths of 5 to 10 feet, the highly glauconitic material may not be acid.

The native vegetation is a hardwood forest consisting of mostly red oak, white oak, willow oak, hickory, yellow-poplar, ash, beech, redcedar, and Virginia pine. Fields left idle soon contain scattered redcedar.

These soils are mostly cleared for crops. but only a small acreage is irrigated. They are mostly used for dairy farming or for growing grain. The most common crops are corn, soybeans, small grains, hay, and pasture, though tomatoes and pumpkins are also grown in places.

Typical profile of Marlton fine sandy loam, 0 to 2 percent slopes, in a field about 2½ miles northwest of Medford:

Ap—0 to 10 inches, dark olive-gray (5Y 3/2) fine sandy loam; moderate, fine, granular structure; friable; more than 40 percent is glauconite; abrupt, smooth boundary; horizon 6 to 12 inches thick.

B2t—10 to 30 inches, dark-olive (5Y 3/3) sandy clay; strong, coarse, angular blocky structure that tends to be prismatic; very firm when moist, very hard when dry, sticky and very plastic when wet; distinct continuous clay films on ped faces; glauconite content high; gradual, smooth boundary; horizon 15 to 30 inches thick.

B3–30 to 40 inches, olive-brown (2.5Y 4/4) and dark olive-gray (5Y 3/2) clay loam; grains of the two colors about equal; moderate, medium and coarse, subangular blocky structure; friable when moist, hard when dry, slightly sticky and plastic when wet; discontinuous clay films on ped faces; glauconite content high; gradual, smooth boundary; horizon 5 to 18 inches thick.

C—40 to 60 inches, dark olive-gray (5Y 3/2) and olive-brown (2.5Y 4/4) sandy loam and sandy clay loam, individual grains in about equal amounts in alternating layers; massive; friable when moist, sticky when wet; 60 to 90 percent is unweathered glauconite; some underlying reddish-brown layers firmly cemented with iron.

Marlton soils contain varying amounts of rounded quartzose pebbles, but they normally are not abundant.

The A horizon is thinner and darker than that in most moderately well drained soils. The darker color is caused by the high glauconite content. The A horizon is 2.5Y or 5Y in hue, 3 or 4 in value, and ranges from 2 to 4 in chroma,

The B horizon ranges from 24 to 48 inches in thickness, but average thickness is about 30 inches. The B horizon is mainly 5Y in hue, but individual grains in the lower part of the horizon are 2.5Y in hue. The B horizon is 3 to 4 in value and ranges from 2 to more than 4 in chroma. In places mottles occur, mostly at a depth of more than 24 inches. These mottles normally are 10YR, 7.5YR, or 5YR in hue, and they are about 4 in value and chroma. In places the B horizon is heavy sandy clay loam in texture.

The C horizon swells when wet and is slowly permeable. It feels sandy, but acts more like clayey soil. In places, thin sheets of iron oxide slow the rate of percolation and cause lateral movement of water.

Marlton soils generally are associated with Kresson, Collington, and Adelphia soils. They lack the mottling in the upper 20 inches that is common in Kresson soils. Marlton soils contain more glauconite than Collington and Adelphia soils and are darker olive.

Marlton fine sandy loam, 0 to 2 percent slopes (MhA).—In high positions this soil generally is nearly well drained and contains excess water only after heavy rains. Areas in low positions require drainage. The profile of this soil is that described as typical for the series. Included with this soil in mapping are areas of Kresson soils and of the glauconitic variant of Adelphia soils.

This soil is well suited to general crops that do not need much cultivation. In some areas, the concentration of surface water can be reduced by stripcropping and terracing. (Capability unit IIs–2; woodland suitability group 2o1)

Marlton fine sandy loam, 2 to 5 percent slopes (MhB).—This soil has moderate runoff, and erosion is a hazard. It has a profile similar to that described as typical for the series. Included with this soil in mapping are eroded areas where plowing exposes the dark-olive sandy clay subsoil. Also included are areas of Collington and Adelphia soils that are sandier than this Marlton fine sandy loam and easier to work.

This soil is well suited to general crops. Stripcropping and terracing have been used to reduce runoff and erosion. (Capability unit IIe–2; woodland suitability group 2o1)

Marlton soils, 5 to 10 percent slopes (MrC).—Although the surface layer of these soils ranges from loamy sand to sandy clay, fine sandy loam is dominant. The sandy clay occurs in severely eroded areas where plowing has exposed the subsoil. Seed germination and plant growth are poor in these areas. Except for texture of the surface layer, these soils have a profile similar to that described as typical for the series.

Included with these soils in mapping are small areas where slopes are steeper than 10 percent. Some included areas had gullies filled from the soil beside the gully.

Where slopes are stronger or erosion has been severe, these soils are better suited to hay or pasture than to row crops. Stripcropping, diversion terraces, and cover crops can be used to reduce erosion. Capability unit IIIe–2; woodland suitability group 2o1)

Marsh Land

Marsh land consists of areas where soil materials are so variable that they cannot be placed in a series. Instead, these areas are described as Marsh, fresh water, and Marsh, tidal.

Marsh, fresh water (Ms).—This mapping unit consists of areas that are covered with water 8 to 10 months of the year. The soils generally are so saturated that they can support little weight.

The largest area is adjacent to Parkers Creek in Mount Laurel Township, where the blocking of the natural stream channel has caused extensive overflow. Drainage improvement in this area is possible but costly. Smaller areas of this marsh occur adjacent to streams on the upper side of many impounded areas. These areas cannot be much improved by drainage.

The native vegetation consists of buttonball bush, rose mallows, and a few other shrubs that can live in water for extended periods. This mapping unit has severe limitations for all uses except habitats for wildlife. (Capability unit VIIIw–29; woodland suitability group unclassified)

Marsh, tidal (Mt).—This soil consists of highly organic silt flats near sea level, where they are flooded twice daily. The soil material is brownish and has an average thickness of about 3 feet. It is 10 feet or more thick in many places and is as little as 1 foot thick in some places. Below the layers of silt are sand and gravel and, in some places, clay.

Marsh, tidal, is most extensive at the mouths of the Mullica, Bass, and Wading Rivers in the southeastern part of the county. Here the waters generally are brackish. Methane or marsh gas forms in many places. Small areas of this marsh occur along the Delaware River and Rancocas, Assiscunk, Crafts, Blacks, and Crosswicks Creeks. In these small areas the floodwaters are fresh.

The native vegetation is salt-tolerant grasses and sedges. Salt hay formerly was harvested, but little is harvested now. Numerous buried logs and stumps were uncovered in a tributary of the Bass River west of Route 9 when the channel was deepened. These logs and stumps indicate that the vegetation may once have been forest. Small areas along the Delaware River and Rancocas Creek formerly were diked and drained for farming. But the dikes were not maintained, and the areas were abandoned.

Marsh, tidal, is well suited as a feeding and breeding area for many water birds and for mammals and crustaceans. It is the best area for hunting waterfowl in the county (fig. 18).

Because areas of this marsh are adjacent to large streams, fresh-water impoundments are not easily constructed in them. During the past 50 years, the Mosquito Commission has constructed many ditches to speed the drainage of flooded land and reduce the mosquito breeding pools.

This marsh has severe limitations to use as farm land, woodland, septic tank disposal fields, and building sites. The organic silts are unstable for foundations. They can support so little weight that it is customary to remove the silt layer before construction of heavy buildings. (Capability unit VIIIw–29; woodland suitability group unclassified)

Muck

Muck, shallow (Mu) consists of about 2 feet of black, finely decomposed, saturated organic matter, generally over sand and gravel but over clayey material in places. In a few places this organic layer is less than 1 foot thick or more than 3 feet thick. Fire has reduced the thickness in places. Included with this Muck in mapping are small areas of sandy soil.

Muck forms in nearly level areas at the headwaters of streams or where the stream flow is slow. Most of these streams flow eastward to the Atlantic Ocean, but there are also areas of Muck along some of the westward flowing streams (fig. 19). Muck also occurs in

Figure 18.—The salt-tolerant vegetation of Marsh, tidal, provides much food and cover for waterfowl.

Figure 19.—This ditch in Muck provides outlet for poorly drained soils on uplands.

round depressions that have no drainage outlet. Muck commonly is associated with Berryland and Atsion soils and Alluvial land, sandy. It can be distinguished from these soils by its high content of organic matter.

Except for some places that support no trees, the native vegetation on Muck is a dense forest of Atlantic white-cedar. Because the market for this wood has been good for a long time, the forests have been cut frequently. The cedars have water constantly available, except in severe droughts, because the water table is at or near the surface of the Muck 10 to 12 months of the year. Because of this water table, the cedars develop a shallow root system and are severely subject to windthrow. Because the saturated Muck supports little weight, track-type tractors and corduroy roads made of tree tops are needed when harvesting the cedar.

Except for cranberries, only a small acreage of Muck is used for farming. Muck is moderately fertile, but lacks a good supply of minerals, especially the minor elements. Except for small areas in the inner Coastal Plain where it forms over highly glauconitic deposits, Muck is extremely acid. It has a high available water capacity. Muck subsides severely when it is drying, and when it is dry it is subject to soil blowing and burning.

Muck is well suited to dug ponds. Its use for foundations is severely limited because the organic layer is unstable. The organic material customarily is removed when heavy buildings are constructed on Muck. (Capability unit VIIw-30; woodland suitability group 3w3)

Nixonton Series

The Nixonton series consists of moderately well drained, moderately coarse textured and coarse textured soils that are nearly level and gently sloping. They occupy intermediate positions between the Pasquotank and Westphalia soils. They formed primarily on the Kirkwood marine deposit, though some material has been deposited by either wind or water.

In a typical profile the surface layer is dark grayish-brown fine sandy loam about 9 inches thick. The subsurface layer is light yellowish-brown fine sandy loam about 3 inches thick. The subsoil is yellowish-brown very fine sandy loam that extends to a depth of about 32 inches. The substratum has alternating layers of gray and light olive-brown fine sand and sand.

Nixonton soils are moderately slow in permeability. When drained, the fine sandy loam has a high available water capacity and the loamy fine sand has a moderately high available water capacity. High-value crops generally are irrigated if the soils are drained. When rainfall is normal, the water table starts to rise in September or October, reaches its peak of 2 feet from the surface late in winter or early in spring, and drops again to a depth of more than 5 feet by the end of May. The water table makes little water available to shallow-rooted crops in summer when it is needed most. When the soil is drained, the water table rises only for short periods.

Organic-matter content is moderate in the moderately coarse textured soils and low in the coarse textured soils. The Nixonton soils are moderately fertile, and added fertilizers leach, but not readily. Because Nixonton soils are very strongly acid, fields need frequent additions of lime.

The native vegetation is a hardwood forest consisting mostly of oak, yellow-poplar, beech, hickory, holly, and scattered Virginia pine. In places there are nearly pure stands of yellow-poplar or beech.

Nixonton soils need drainage, especially when irrigated high-value crops are grown. Either open ditches or underdrains can be used. Because saturated fine sands flow easily, ditchbanks collapse. This hazard, however, can be reduced by digging ditches in summer.

Nixonton soils are suitable for dug ponds and have a moderately limited use for homesites and septic tank disposal fields. Underdrains are used around foundations and under basement floors to reduce wetness. Deep ditches lower the water table in the disposal fields more effectively than land filling.

Typical profile of Nixonton fine sandy loam, 0 to 2 percent slopes, in a rotational hayfield one-fourth mile east of Pemberton:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable; few rounded quartzose pebbles; abrupt, smooth boundary; horizon 8 to 12 inches thick.

A2—9 to 12 inches, light yellowish-brown (2.5Y 6/4) fine sandy loam; very weak, fine, granular structure; very friable; clear, smooth boundary; horizon 2 to 8 inches thick.

B21t—12 to 24 inches, yellowish-brown (10YR 5/6) very fine sandy loam; few, fine and medium, faint mottles of yellowish brown (10YR 5/8); weak, coarse, subangular blocky structure; friable; slightly sticky, nonplastic when wet; sand grains with weak clay bridging, many fine pores, small amounts of fine mica; clear, wavy boundary; horizon 10 to 20 inches thick.

B22g—24 to 32 inches, yellowish-brown (10YR 5/6) very fine sandy loam; common, medium, prominent mottles of light gray (10YR 7/1) and light olive gray (5Y 6/2); weak, coarse, subangular blocky structure; friable; clear wavy boundary; horizon 0 to 20 inches thick.

C—32 to 60 inches, alternating layers of gray (5Y 6/1) and light olive-brown (2.5Y 6/4) fine sand and sand; single grain or massive; loose or very friable.

Nixonton soils contain varying amounts of rounded quartzose pebbles, but normally these are not abundant. They are most common in the C horizon, especially where the fine sands have been redeposited. The areas where materials of the C horizon have been redeposited are minor in extent.

The solum ranges from 24 to 40 inches in thickness. Forested areas have a very dark A1 horizon about 4 inches thick. A gray horizon 1 to 3 inches thick occurs below the A1 horizon in places, especially in the loamy fine sand. When plowed, these two horizons are destroyed and mixed with some of the yellowish-brown A2 horizon to form the Ap horizon. The Ap horizon is 2.5Y or 10 YR in hue, 4 or 5 in value, and 2 or 3 in chroma. It is fine sandy loam or loamy fine sand in texture. The A2 horizon is 2.5Y or 10YR in hue and 5 or 6 in value.

The B horizon ranges from 10 to 30 inches in thickness. It is 2.5Y or 10YR in hue, 5 or 6 in value, and ranges from 4 to 6 in chroma. Mottles range from 1 to 8 in chroma. The clay content is 5 to 10 percent higher than in the A horizon, with the greatest difference between horizons in the loamy fine sand. Silt content of both the A and B horizons is 10 to

14 percent. The B horizons contain 35 to 45 percent very fine sand and 25 to 40 percent fine sand.

The C horizon ranges from 5Y to 10YR in hue, from 5 to 7 in value, and from 1 to 8 in chroma. It generally consists of lamella or stratified horizons of two textures. The dominant texture is generally loose sand and the other texture generally is massive fine sandy loam.

These soils are associated with Westphalia, Pasquotank, Freehold, and Holmdel soils. Nixonton soils developed in the same kind of material as the Westphalia and Pasquotank soils, but they contain mottles that the Westphalia soils lack and they are neither so dark in the surface layer nor so gray in the subsoil as are the Pasquotank soils. Nixonton soils lack the glauconite common to Freehold and Holmdel soils. Nixonton soils appear similar to Woodstown soils, but contain larger amounts of very fine sand and fine sand.

Nixonton fine sandy loam, 0 to 2 percent slopes (NbA).—This soil has the profile described as typical for the series. Included with this soil in mapping are areas of Nixonton loamy fine sand and Westphalia and Pasquotank soils. A small area along North Branch Rancocas Creek, east of Pemberton, is subject to flooding when the branch is abnormally high.

This soil needs drainage, especially if it is used for irrigated vegetables. The water table can be kept down by use of open ditches or underdrains. Ditchbank maintenance is costly because this soil flows readily when saturated. (Capability unit IIw–14; woodland suitability group 2w1)

Nixonton fine sandy loam, 2 to 5 percent slopes (NbB).—This soil has a profile similar to that described as typical for the series. Runoff and the hazard of erosion are moderate.

Included with this soil in mapping are small areas of Nixonton loamy fine sand and of Westphalia and Pasquotank soils. Also included are small areas where the slope is less than 2 percent or more than 5 percent.

This soil needs drainage, especially if irrigated crops of high value are grown. Because this soil flows readily when saturated, maintaining ditchbanks is costly. Cover crops and contour farming have been used to reduce the erosion hazard. (Capability unit IIw–14; woodland suitability group 2w1)

Nixonton loamy fine sand, 0 to 2 percent slopes (NcA).—Except that it has a loamy fine sand surface layer 16 inches thick, this soil has a profile similar to that described as typical for the series. Included with this soil in mapping are small areas of Westphalia and Pasquotank soils, Nixonton fine sandy loam, and Nixonton soils of more than 2 percent slopes.

This soil needs drainage, especially if irrigated crops of high value are grown. Although maintaining ditchbanks on this readily flowing fine sand is costly, open ditches and underdrains can be used to keep the water table low. This soil requires more frequent application of irrigation water than the Nixonton fine sandy loams.

Soil blowing is a hazard on this soil, but it can be reduced by use of cover crops, windbreaks, or wind stripcropping. (Capability unit IIw–15; woodland suitability group 2w1)

Nixonton loamy fine sand, 2 to 5 percent slopes (NcB).—Runoff and the hazard of erosion are moderate on this soil. This soil is also subject to soil blowing. Except that the surface layer is loamy fine sand about 16 inches thick, this soil has a profile similar to that described as typical for the series. Included with this soil in mapping are areas of Nixonton fine sandy loam and Westphalia and Pasquotank soils.

Where it is drained, this soil is suitable for early vegetables. It needs more frequent application of irrigation water than the Nixonton fine sandy loams. Contour farming can reduce the hazard of erosion on this soil. Cover crops, windbreaks, or wind stripcropping can be used to reduce soil blowing. (Capability unit IIw–15; woodland suitability group 2w1)

Pasquotank Series

The Pasquotank series consists of mottled grayish soils that developed in water-laid deposits of uniform fine sand. The original deposits were marine, but most areas show signs of redeposition by glacial melt water. These soils are nearly level and occur in low positions where they receive much runoff from the slopes above. In places they form in circular depressions that have no natural outlet. They are poorly drained, and some areas are ponded late in winter.

In a typical profile the surface layer is dark-gray fine sandy loam about 9 inches thick. The subsurface layer is mottled grayish-brown very fine sandy loam about 5 inches thick. The subsoil is light brownish-gray mottled very fine sandy loam that extends to a depth of about 30 inches. The substratum consists of alternating layers of light-gray sand and loamy sand.

Pasquotank soils are saturated 6 to 8 months of the year and are ponded in places when rains are heavy in summer. The water table normally drops below a depth of 3 feet in summer, rises slowly early in fall, and remains high until late in spring. In places the ground water is under pressure and rises in the soil when the subsoil is penetrated. The subsoil, the most slowly permeable horizon in the Pasquotank soils, is moderately slow in permeability.

Because Pasquotank soils generally are in frost pockets, they warm slowly in spring. They are moderate in available water capacity, fertility, and organic-matter content. Except for recently limed fields, they are very strongly acid.

The native vegetation is a hardwood forest consisting of pin, willow, swamp white, and southern red oaks and yellow-poplar, ash, beech, holly, sweetgum, and red maple. The dense understory consists of highbush blueberry, spicebush, and viburnum. Sweetgum seeds readily in abandoned fields and occupies the site 50 to 80 years before the other hardwoods become established.

Most of the acreage in Pasquotank soils has been cleared for crops. When adequately drained, these soils are used mostly for soybeans, corn, small grains, hay, pasture, blueberries, and late-planted vegetables. They are not suited to alfalfa, fruit, and asparagus. The soils generally are suitable as sites for dug ponds.

Surface drainage may be needed in places to prevent loss of high-value vegetables or small grains, and underdrains or ditches can be used to lower the water table.

Typical profile of Pasquotank fine sandy loam in a rotational pasture 0.8 mile east of Pemberton:

Ap—0 to 9 inches, dark-gray (10YR 4/1) fine sandy loam; weak, fine, granular structure; very friable; abrupt, smooth boundary; horizon 8 to 12 inches thick.

A2g—9 to 14 inches, grayish-brown (2.5Y 5/2) fine sandy loam; common, faint to distinct, light brownish-gray (2.5Y 6/2) and yellowish-brown (10YR 5/6) mottles; very weak, medium to thick, platy structure; very friable when moist, slightly sticky, nonplastic when wet; many fine pores; clear, smooth boundary; horizon 2 to 6 inches thick.

B2tg—14 to 30 inches, light brownish-gray (2.5Y 6/2) very fine sandy loam; common, coarse, distinct mottles of yellowish brown (10YR 5/8); weak, medium, subangular blocky structure; friable, slightly sticky, slightly plastic when wet; few fine pores; some sand grains weakly bridged; clear, wavy boundary; horizon 10 to 24 inches thick.

Cg—30 to 60 inches, alternating layers of light-gray (5Y 6/1) sand and loamy sand; single grain or massive; loose or very friable.

Small amounts of rounded quartzose pebbles may occur throughout the Pasquotank soils. Where present, they are most abundant in the C horizon.

The A horizon ranges from dark grayish brown to grayish brown, dark gray, and gray. The B horizon is grayish brown, light brownish gray, or gray, and it has mottles of yellowish brown or strong brown. The mottles range from prominent to distinct and from few to many.

Depth to the C horizon ranges from 20 to 40 inches. The C horizon consists of coarser material than the horizons above. Sandy loam layers alternate with sand layers in places. The C horizon ranges from gray to strong brown and is mottled in some places.

Pasquotank soils generally are associated with Nixonton, Pocomoke, Fallsington, and Shrewsbury soils. Pasquotank soils are grayer than the Nixonton soils and contain much more uniform fine sand than Fallsington and Pocomoke soils. They lack the glauconite content and greenish-gray or olive-gray colors that are common in Shrewsbury soils.

Pasquotank fine sandy loam (Pa).—This soil has the profile described as typical for the series, but areas of Nixonton and Pocomoke soils commonly are included with it in mapping. Also included in places are areas of loamy fine sand. These included areas may have a discontinuous dark-brown organic horizon in the upper part of the subsoil.

In areas where the fine sands have been redeposited by melt water, the mixing of the medium and coarse sands and rounded quartzose gravel is greater than normal. This coarser material generally occurs in pockets in an unpredictable pattern. In areas where it formed over glauconitic deposits, this soil contains some glauconite and in places it is greenish gray or olive gray.

Underdrains or ditches are needed for good crop growth. Ditchbanks are unstable, however, and are subject to severe flowing when the fine sands are saturated. The flowing of sands can be reduced if this soil is ditched in summer and the banks are sloping and covered with vegetation. (Capability unit IIIw-20; woodland suitability group 3w2)

Pemberton Series

The Pemberton series consists of nearly level or gently sloping soils that have a thick, very sandy surface layer and a mottled glauconitic fine sandy loam subsoil. These soils are mostly moderately well drained, but some areas are somewhat poorly drained. Pemberton soils formed in material containing small amounts of glauconite. This material originally was marine deposits, but it is thought to have been redeposited by wind. This is because it is much more common on the south side of streams than on the north side and because it lacks gravel in the substratum.

In a typical profile, the surface layer is dark grayish-brown sand about 10 inches thick and the subsurface layer is light yellowish-brown sand about 14 inches thick. The subsoil is yellowish-brown fine sandy loam about 10 inches thick, and the substratum is olive sand. The subsoil contains a small amount of glauconite, as do the other horizons in most places.

Permeability of the Pemberton soils is moderate to rapid in the surface layer, moderate in the subsoil, and moderately rapid in the substratum. Available water capacity is low. The water table starts to rise in about October, reaches its peak of 2 feet below the surface late in winter, and drops again to a depth of more than 5 feet by June. These soils are low in organic-matter content and very low in fertility. Added fertilizers leach readily.

The native vegetation of these soils is a hardwood forest consisting of mostly oaks, hickories, and scattered Virginia pines. Virginia pines invade idle fields and occupy the site for many years before the hardwoods are reestablished.

About three-fourths of the acreage has been cleared for crops. It is used most extensively for irrigated high-value vegetables such as sweet corn, onions, carrots, and tomatoes. Small grains, soybeans, hay, and a small acreage of pasture and field corn are also grown.

Pemberton soils warm early in spring and are easy to work, even after heavy rains. They are readily drained by open ditches or underdrains. Where irrigation is used these soils should first be drained to prevent crop losses during periods of heavy rainfall. The surface layer of loose sand is subject to soil blowing. Crops are subject to sandblasting by wind-driven sand and to scalding by heat reflected from the sand. Because these soils are very strongly acid, they need periodic additions of small amounts of lime. They are moderately limited for use as sites for dug ponds.

Typical profile of Pemberton sand in a cultivated field 2 miles south of Masonville, east of Ark Road in Hainesport Township:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) sand; single grain; loose; glauconite content low; smooth, abrupt boundary; horizon 8 to 12 inches thick.

A2—10 to 24 inches, light yellowish-brown (10YR 6/4) sand; single grain; loose; sand grains nearly clean; glauconite content low; smooth, gradual boundary; horizon 10 to 20 inches thick.

B2t—24 to 34 inches, yellowish-brown (10YR 5/6) fine sandy loam; common, medium, distinct mottles of olive gray (5Y 5/2); weak, medium, subangular blocky structure; friable; sand grains bridged with clay; glauconite content low; abrupt, smooth boundary; horizon 8 to 30 inches thick.

C—34 to 60 inches, olive (5Y 4/3) sand with many dark glauconite grains; single grain; loose.

Pemberton soils contain varying amounts of quartzose pebbles, generally from 0 to 10 percent. Although pebbles are most abundant in the C horizon, they occur scattered on the surface and in the subsoil in places.

Wooded Pemberton soils normally have a very dark A1 horizon about 4 inches thick. In some places this is underlain by a bleached gray horizon 3 inches or less thick. When the soil is plowed, these two horizons are destroyed and mixed with some of the A2 horizon to make up the Ap layer.

The Ap horizon normally is 3 or 4 in value, but it ranges to 5 where there has been active soil blowing. It is 1 or 2 in chroma. The A2 horizon is 10YR or 2.5Y in hue, 5 or 6 in value, and ranges from 2 to 6 in chroma. The A2 horizon is mottled in the lower part in places. The A horizon has a minimum thickness of 20 inches.

The B horizon ranges from 10YR to 2.5Y in hue, is 4 or 5 in value, and ranges from 4 to 6 in chroma. Mottles vary widely in this horizon. They range from 10YR to 5Y in hue, from 4 to 6 in value, and from 2 to 8 in chroma.

The C horizon ranges from 1 to 4 in chroma and is mottled in places. It is stratified sand and loamy sand in most places, but sand is dominant.

Pemberton soils occur with Tinton soils on long narrow terraces on the south side of the major streams, such as Rancocas and Assiscunk Creeks. They also are associated with Freehold and Holmdel soils. Mottling in Pemberton soils distinguishes them from the Tinton soils. Pemberton soils have a thicker surface layer than the Freehold and Holmdel soils.

Pemberton sand, 0 to 5 percent slopes (PbA).—This soil is subject to soil blowing because much of the sand is fine. It has the profile described as typical for the series. Included with this soil in mapping are areas of Pemberton soil that have a thick surface layer and of Tinton, Holmdel, and Freehold soils. Also included are areas of loamy sand.

Where it has been drained, this soil is suited to irrigated vegetables. Extensive exposed areas need to be protected against soil blowing by the use of windbreaks, cover crops, or windstrips. (Capability unit IIIw–15; woodland suitability group 3s1)

Pemberton sand, thick surface, 0 to 5 percent slopes (PcA).—The surface layer of this soil is at least 30 inches thick. Average thickness is 35 inches. The subsoil is about 14 inches thick. Except for the thickness of the surface layer, this soil has a profile similar to that described as typical for the series. Included with this soil in mapping are areas of Pemberton sand and of Tinton, Holmdel, and Freehold soils.

This soil is not suited to crops, even when irrigated. Fertility is very low and cannot easily be improved. This soil needs very frequent irrigation when used for crops, and it is subject to soil blowing.

This soil is suitable for use as woodland and for growing food and cover for wildlife. It is especially suited to the deep-rooted perennial plants. (Capability unit IIIw–16; woodland suitability group 3s1)

Pits

This land type consists of pits opened to excavate sand and gravel or clay and marl.

Pits, sand and gravel (Pt).—These pits, ranging from 4 to 20 feet in depth, were opened to excavate sand, gravel, and borrow material. Both sand and gravel have been taken from some of them. Most pits are at the tops of knolls, and the material is taken from them by loaders and trucks. Where the pits are in low places and extend below the water table, the material is taken by hydraulic pumps. After excavation was completed, some pits were converted to swimming areas. Olympia Lakes and Pemberton Lakes are examples.

A number of pits adjacent to the New Jersey Turnpike and Garden State Parkway were opened to obtain fill material for constructing the two roadways. Since sandy areas generally were selected, the borrow areas are similar to the sand and gravel pits. They are, however, more likely to be underlain by clay beds.

Sand is more abundant than gravel in this mapping unit. It has many uses in building, industry, and the making of soil-cement. Gravel is most abundant where the material has been deposited by glacial melt waters. Along the Delaware River a deposit of pebbles, cobblestones, and boulders below the soil at about sea level is called stratified drift. Much of this material consists of shale, sandstone, gneiss, and diabase.

Permeability is rapid, and available water capacity and fertility are very low. Organic-matter content is low, and added fertilizers leach readily. This land is extremely acid. Large exposed areas are subject to soil blowing.

Areas in the higher positions are suited to pine trees, though growth is slow at first. They are also suitable for wildlife habitats. (Capability and woodland suitability unclassified)

Pits, clay and marl (Pu).—This land consists of pits excavated for clay and marl. The clay was excavated primarily to make bricks, and the marl was used as a fertilizer. The source of the material was the Merchantville, Woodbury, and Hornerstown Formations. These formations contain iron pyrite, which can form sulfuric acid. In places ponds in these clay pits are so acid that fish cannot reproduce (fig. 20).

Abandoned clay pits normally have abrupt vertical side slopes, but some have been smoothed. Revegetation of these slopes is slow, partly because extreme acidity and severe frost heaving prevent most plants from living through the first winter.

Figure 20.—**In places, ponds in abandoned clay pits are extremely acid.**

The marl pits were excavated between 1850 and 1900 and are now all abandoned. Nearly all areas are overgrown with sweetgum, yellow-poplar, hickory, and many other trees and shrubs. The walls of the pits have become gently sloping, and only a few areas still contain water. The underlying beds are almost neutral and are very productive when stocked with fish.

Neither clay nor marl pits are suited to crops or pasture. They are suitable as sites for dug ponds and have moderate limitations as woodland and as wildlife habitats. The pits receive much runoff from the slopes above, and they are slowly permeable. Where they are smoothed and graded for paving, a frost-free surface application is needed to prevent frost heaving. (Capability and woodland suitability unclassified)

Pocomoke Series

The Pocomoke series consists of very poorly drained soils that have a very dark fine sandy loam surface layer. These soils formed in very low positions where they receive much runoff from the slopes above, or they are on extensive flats that lack deep natural drainage. In Burlington County they are formed in water-laid materials that were mostly redeposited by glacial melt waters.

In a typical profile, the surface layer is black fine sandy loam about 10 inches thick and the subsurface layer is light-gray fine sandy loam about 5 inches thick. The subsoil, about 13 inches thick, is gray fine sandy loam mottled with yellowish brown. It overlies a layer of light-gray stratified sand and gravelly sand that extends to a depth of 5 or more feet.

In their natural state, Pocomoke soils are saturated 8 to 10 months of the year, and they have a high water table. Late in winter the water is at the surface, or it is ponded. In summer it drops to a depth of about 2 feet. Where they are drained, these soils have a moderately high available water capacity. The subsoil is moderately permeable. Because they are gently sloping and occur in low positions, Pocomoke soils drain slowly. These soils are high in organic-matter content.

The native vegetation is a hardwood forest consisting of pin oak, willow oak, southern red oak, swamp white oak, sweetgum, blackgum, holly, and red maple. The dense understory consists of sweet pepperbush, highbush blueberry, sheep laurel, bayberry, and greenbrier.

If adequately drained, Pocomoke soils are suited to soybeans, corn, small grains, late vegetables, blueberries, hay, and pasture. They are not suited to fruit, alfalfa, or asparagus.

These soils are moderately fertile, and added fertilizers do not leach readily. Because they are very strongly acid, they require frequent additions of lime. They warm late in spring and become wet early in fall, even where drainage is provided. Heavy rains are likely to cause ponding. In places Pocomoke soils occur in frost pockets. The water table can be lowered by open ditches or underdrains. In places, however, drainage outlets are difficult to find or expensive to install and maintain. These soils are well suited as sites of dug ponds.

Typical profile of Pocomoke fine sandy loam in a cultivated field about a half mile southwest of Tabernacle School:

Ap—0 to 10 inches, black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) when dry; weak, medium, granular structure; very friable, nonsticky when wet; abrupt, smooth boundary; horizon 8 to 12 inches thick.

A2g—10 to 15 inches, light-gray (10YR 6/1) fine sandy loam; common, medium, faint mottles of yellowish brown (10YR 5/4) and white (10YR 8/2); weak, medium, granular structure; very friable; sand grains clean; gradual, wavy boundary; horizon 0 to 6 inches thick.

B2tg—15 to 28 inches, gray (5Y 5/1) heavy fine sandy loam, light gray (5Y 7/1) when dry; many medium to coarse, prominent mottles of yellowish brown (10YR 5/6) diminishing in number and size with increased depth; moderate, medium and coarse, subangular blocky structure that tends to be thick and platy; friable, slightly sticky and slightly plastic when wet; few fine pores; sand grains weakly bridged, thin discontinuous clay films in root channels; about 5 percent is rounded quartzose pebbles; abrupt, wavy boundary; horizon 10 to 24 inches thick.

IICg—28 to 60 inches, alternating layers of light-gray (10YR 7/1) sand and gravelly sand and yellowish-brown (10YR 5/4) sandy loam; single grain or massive; loose or very friable.

The solum ranges from 20 to 40 inches in thickness. Rounded quartzose pebbles generally are not abundant in any horizon. They are most abundant in the C horizon, but they occur in the A and B horizons in places.

In places the Ap horizon is sandy loam. The Ap horizon is 2 or 3 in value and 1 or 2 in chroma. The dark surface layer generally is less than 10 inches thick, but it is as much as 14 inches thick in places.

The B horizon is sandy clay loam in places in the inner Coastal Plain. The C horizon generally includes strata of more than one texture, and the finest of these materials controls permeability.

Pocomoke soils are associated mostly with Fallsington, Pasquotank, and Woodstown soils. Pocomoke soils have a darker A horizon than any of these associated soils, and they are grayer than the Woodstown soils. Sands in the Pocomoke soils are not so consistently fine as in the Pasquotank soils. Pocomoke soils resemble Keansburg soils but generally do not occur with them. Pocomoke soils lack the olive-gray colors and the glauconite common in the Keansburg soils.

Pocomoke fine sandy loam (Pv).—This soil has the profile described as typical for the series. Included with this soil in mapping are areas of Fallsington and Pasquotank soils and small areas of Woodstown soils. Also included, along the north side of North Branch Rancocas Creek east of Pemberton, is a large area that is subject to flooding.

Deep drainage, carefully installed and maintained, is needed if this soil is to be farmed successfully. Open ditches or underdrains can be used to lower the water table. (Capability unit IIIw–24; woodland suitability group 3w2)

Sandy Land, Ironstone

Sandy land, ironstone (Se) consists of about 2 feet of sand over discontinuous ironstone layers ½ to 2 feet thick. Slopes generally are 5 to 15 percent, but in some places are more than 15 percent. The ironstone occurs in about 60 to 70 percent of the area. Because the ironstone formerly was quarried extensively, the soil ma-

terial contains many manmade depressions and loose stones. Many of the early meeting houses and homes were made from the ironstone.

This land occurs in small and in some extensive areas, generally as caps of the highest knolls. The largest area is at Arneys Mount; others are at Julius Mount, Mount Holly, Mount Laurel, Stony Mountain, and many knolls in the outer Coastal Plain. At Arneys Mount the ironstone occurs over glauconitic beds, but in the outer Coastal Plain it occurs over clay layers.

The native vegetation is a forest of hardwoods or pines. Because of the strong slopes and shallow depth to bedrock, this soil is not suitable for cultivation. Because of its position, it is highly desirable as a homesite, but there may be severe limitations to excavation.

This soil is rapidly permeable above the ironstone. It is low in fertility and in available water capacity. Erosion is a hazard in some places. (Capability unit VIIs–8; woodland suitability group 3s1)

Sassafras Series

The Sassafras series consists of well-drained, moderately coarse textured soils formed in water-laid deposits that contain little or no glauconite. Although the surface layer and the subsoil have the same textural class, the subsoil distinctly contains more clay than the surface layer. The substratum is very sandy and contains large amounts of gravel in places. These soils are mostly nearly level or gently sloping, though they have slopes of 5 to 10 percent in some places.

In a typical profile, the surface layer is dark grayish-brown fine sandy loam about 10 inches thick and the subsurface layer is yellowish-brown fine sandy loam about 4 inches thick. The subsoil is fine sandy loam that extends to a depth of 34 inches. It is dark brown in the upper 14 inches and yellowish brown below. The substratum is light yellowish-brown loamy sand containing some gravel.

Sassafras soils are moderately permeable. The available water capacity, organic-matter content, and fertility are moderate except where the surface layer is loamy sand. The loamy sand has moderately low available water capacity and fertility and low organic-matter content. Sassafras soils are very strongly acid unless heavily limed.

The native vegetation is a hardwood forest consisting mostly of red oak, white oak, black oak, scarlet oak, hickory, beech, yellow-poplar, and scattered Virginia pine. Pines are more abundant in the outer Coastal Plain than in the inner Coastal Plain, and they seed readily in idle fields.

In the inner Coastal Plain, nearly all areas of Sassafras soils have been cleared for farming. High-value vegetables were grown under irrigation, but now much of this area is being developed for residential, commercial, and industrial uses.

Sassafras soils are easily worked. They respond well to fertilization. Fields require frequent applications of lime to keep from becoming strongly acid.

Typical profile of Sassafras fine sandy loam, 0 to 2 percent slopes, in a cultivated field northeast of Rancocas:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable; abrupt, smooth boundary; horizon 8 to 12 inches thick.

A2—10 to 14 inches, yellowish-brown (10YR 5/4) light fine sandy loam; weak, fine, granular structure; very friable, nonsticky, nonplastic; sand grains clean; clear, smooth boundary; horizon 3 to 5 inches thick.

B2t—14 to 28 inches, dark-brown (7.5YR 4/4) heavy fine sandy loam; moderate medium, subangular blocky structure; very friable, slightly sticky, slightly plastic; common medium pores; thin discontinuous clay films on ped faces; gradual, smooth boundary; horizon 10 to 20 inches thick.

B3–28 to 34 inches, yellowish-brown (10YR 5/6) light fine sandy loam; very weak, medium, subangular blocky structure; very friable; nonsticky, nonplastic; gradual, smooth boundary; horizon 0 to 14 inches thick.

C—34 to 60 inches, light yellowish-brown (10YR 6/4) loamy sand; single grain; loose; 2 to 5 percent is rounded quartzose pebbles that are as much as 2 inches in diameter.

Sassafras soils contain varying amounts of rounded quartzose pebbles and in places a few cobblestones. These are most abundant close to the Delaware River. The pebbles are most abundant in the C horizon. The solum ranges from 24 to 42 inches in thickness, and soils near the Delaware River tend to be 4 to 8 inches thicker than those farther inland.

Wooded areas generally have a very dark A1 horizon about 4 inches thick. The loamy sand and some areas of fine sandy loam are a bleached gray in the upper part of the A2 horizon. When plowed, the A1 horizon and upper part of the A2 horizon are mixed with some of the lower part of the A2 horizon to form the Ap horizon. The Ap horizon is 2.5Y in hue. The A2 horizon is 5 or 6 in value.

The B horizon is sandy clay loam in places, especially close to the Delaware River. Near the river the B horizon has a hue of 5YR. Near Indian Mills this horizon is 10YR in hue and as high as 8 in chroma.

The C horizon normally is loamy sand, gravelly sand, or sand, but it is sandy loam in places. Where finer textures ranging from clay loam to clay underlie the solum, they are mapped as separate clayey substratum units.

Sassafras soils are associated with Woodstown, Freehold, Holmdel, and Downer soils. Sassafras soils lack the mottles that occur in the Woodstown and Holmdel soils and the glauconite that occurs in the Freehold soils. Sassafras soils have a finer textured subsoil than the Downer soils. Near the Delaware River Sassafras soils normally occupy high positions above Woodstown and Holmdel soils. Sassafras and Woodstown soils developed in material deposited by glacial water on the glauconitic marine deposits in which Freehold and Holmdel soils formed. The glacial deposits contain large amounts of rounded quartzose pebbles, a few iron-cemented stones 5 to 10 feet in diameter, and small amounts of glauconite. None of these are present in Sassafras soils in the Indian Mills and Tylertown areas.

Sassafras loamy sand, 0 to 5 percent slopes (SfB).—This soil has a surface layer about 16 inches thick and a subsoil about 14 inches thick. The subsoil is reddish brown in most places. This soil is most extensive in Cinnaminson Township, where it is rapidly being used for community development. One area of this soil is near Tylertown in the outer Coastal Plain. The profile of this soil is similar to that described as typical for the series.

Most of this soil has been used for vegetables and nursery plants. Where planted to high-value crops, this soil requires more frequent application of irriga-

tion water than Sassafras fine sandy loam. In extensive exposed areas soil blowing is a hazard.

Where this soil is shallow over underlying clay beds, it contains excess water in some areas when rainfall is heavy. In places pieces of ironstone 5 to 10 feet in diameter and several feet thick occur above these clay deposits. (Capability unit IIs–6; woodland suitability group 2o1)

Sassafras fine sandy loam, 0 to 2 percent slopes (SgA).—This soil has the profile described as typical for the series. It is well suited to crops and can be used for nearly all crops grown in the area except the earliest vegetables.

Small areas of this soil may need drainage if high-value crops are grown. Most high-value crops are irrigated (fig. 21). Where a normally fertilized cover crop follows a highly fertilized crop, enough organic matter generally is provided to keep the soil porous. The soil, however, is compacted if cropping is intensive, but compaction can be reduced by subsoiling, resting the land, or seeding cover crops. (Capability unit I–5; woodland suitability group 2o1)

Sassafras fine sandy loam, 2 to 5 percent slopes (SgB).—This soil is subject to runoff and erosion. It has a profile similar to that described as typical for the series. Included with this soil in mapping are some areas of sandy loam and small areas that have underlying clayey layers. Spot drainage may be needed because water is excessive above the clayey layers.

This soil is suited to most crops if care is taken to prevent soil compaction where cropping is intensive. Most high-value crops are irrigated. (Capability unit IIe–5; woodland suitability group 2o1)

Sassafras fine sandy loam, 5 to 10 percent slopes (SgC).—This soil normally has a surface layer about 10 inches thick and lacks the subsurface layer. In other respects it has a profile similar to that described as typical for the series.

Runoff is rapid on this soil, and the erosion hazard is severe in farmed or bare areas. Some fields are gullied, and in many places former gullies have been filled from adjacent areas. Erosion can be reduced in fields by the use of cover crops, stripcropping, or terraces. In urban areas a sod cover can be used. (Capability unit IIIe–5; woodland suitability group 2o1)

Sassafras fine sandy loam, clayey substratum, 0 to 2 percent slopes (ShA).—Except for a clayey substratum that normally is at a depth of 40 to 60 inches but in places is only 30 inches from the surface, this soil has a profile like that described as typical for the series. Where the clayey layers are close to the surface, excess water may be held for short periods after heavy rains. These spots may need to be drained. The clayey layers are thick because they are part of thick geologic deposits. They generally are very dark gray and range from clay to silty clay to heavy clay loam in texture. The clayey layers are slowly permeable and increase the water available for crops, at least for the deep-rooted ones.

Except for the wet spots, this soil is similar to Sassafras fine sandy loam, 0 to 2 percent slopes, in use and management for farming. Limitations for use as a homesite are slight, but limitations for use as septic tank disposal fields are severe because the underlying layer is slowly permeable (fig. 22). (Capability unit I–5; woodland suitability group 2o1)

Sassafras fine sandy loam, clayey substratum, 2 to 5 percent slopes (ShB).—The clayey substratum of this soil is at a depth of 40 to 60 inches in most places, but in some places it is only about 30 inches from the surface. Runoff is moderate, and erosion is a moderate hazard. Except for the clayey substratum, this soil has a profile similar to that described as typical for the series.

Where this soil is used for crops, erosion can be reduced by use of cover crops and stripcropping. Interceptor underdrains can be used in many fields to reduce the lateral movement of water over the clayey layers. (Capability unit IIe–5; woodland suitability group 2o1)

Figure 21.—Irrigated tomatoes on Sassafras fine sandy loam.

Figure 22.—Blocky structure of clay substratum between depths of 3 and 5 feet severely limits percolation in septic tank disposal fields. The soil is Sassafras fine sandy loam, clayey substratum, 0 to 2 percent slopes.

Sassafras-Urban land complex (Sk).—This complex has 0 to 5 percent slopes. Nearly all of it is used for community development. Included with this complex in mapping are some areas of Freehold and Woodstown soils.

Because most of this area was developed many years ago, one property at a time, the soil was not disturbed as it is in extensive modern developments. It is estimated that Sassafras soil remains in position in about 70 percent of the area. (Capability and woodland suitability unclassified)

Sassafras-Urban land complex, clayey substrata (Sm).—This complex is similar to Sassafras-Urban land complex, except that both the Sassafras soil and the Urban land are underlain by clayey layers. These layers are at a depth of 40 to 60 inches in most places.

Nearly all of this complex is in community development. Homes with basements need underdrains, and the clayey substrata severely limit the use of this complex for septic tank disposal fields. (Capability and woodland suitability unclassified)

Shrewsbury Series

The Shrewsbury series consists of nearly level, wet, mottled gray soils that contain small to moderate amounts of glauconite. These soils are poorly drained and occur in low positions where they receive much surface and substratum water from the slopes above. They formed in redeposited marine material.

In a typical profile the surface layer is dark-gray fine sandy loam about 10 inches thick. The subsurface layer is gray mottled fine sandy loam about 4 inches thick. The subsoil is prominently mottled fine sandy clay loam that extends to a depth of 32 inches. It is gray and greenish gray in the upper 10 inches and greenish gray below. The substratum consists of alternating layers of olive-gray loamy sand and fine sandy loam and of prominently mottled white sand.

In their natural condition, Shrewsbury soils are saturated 6 to 8 months of the year. Normally water is about 4 feet below the surface in summer. The water table starts to rise in September, reaches a depth of 1 foot by November, and remains at that level until it starts to drop in April. It reaches a depth of 4 feet again by late in May. When these soils are drained, the water table does not remain high for long periods. These soils are moderately permeable. They are moderately fertile and moderately high in organic-matter content.

The native vegetation is a hardwood forest consisting of lowland species such as willow oak, pin oak, swamp white oak, ash, beech, hickory, sweetgum, and red maple. The undergrowth is viburnum, spicebush, elderberry, and greenbrier.

Where drained, Shrewsbury soils are suited to corn, soybeans, small grains, hay, pasture, blueberries, and late vegetables. Irrigation is seldom needed. These soils are not well suited to alfalfa and fruit.

These soils warm late in spring, and in some places they are subject to flooding. Where drained, they have a high available water capacity. In their natural state these soils are very strongly acid, but acidity has been reduced in heavily limed fields. Added fertilizers do not leach readily.

Shrewsbury soils are generally good sites for dug ponds. Where there are underlying clayey layers, however, the recharge rate is likely to be slow.

Typical profile of Shrewsbury fine sandy loam in a cultivated field 0.2 mile north of Oxmead Road just off Gilbert's Lane in Springfield Township:

Ap—0 to 10 inches, dark-gray (10YR 4/1) fine sandy loam; weak, medium, granular structure; very friable; slightly sticky, slightly plastic when wet; glauconite content less than 5 percent; abrupt, smooth boundary; horizon 8 to 12 inches thick.

A2g—10 to 14 inches, gray (5Y 6/1) fine sandy loam; many, medium, prominent mottles of yellowish brown (10YR 5/6) or dark yellowish brown (10YR 4/4); weak, medium, granular to very weak, medium, subangular blocky structure; very friable, slightly sticky and slightly plastic when wet; glauconite content less than 5 percent; clear, smooth boundary; horizon 0 to 6 inches thick.

B21tg—14 to 24 inches, fine sandy clay loam that is gray (5Y 5/1) when moist and light olive gray (5Y 6/2) when dry and is greenish gray (5GY 5/1) when moist and light gray (2.5Y 7/1) when dry; many, fine and medium, prominent mottles of brownish yellow (10YR 6/8); moderate, coarse, subangular blocky structure; friable, slightly sticky and plastic when wet; many fine pores; thin patchy clay films on ped faces and in root channels; glauconite content 5 to 10 percent; clear, smooth boundary; horizon 5 to 15 inches thick.

B22tg—24 to 32 inches, greenish-gray (5GY 5/1) fine sandy clay loam; common, medium, prominent mottles of yellowish brown (10YR 5/8); very weak, coarse, subangular blocky structure; friable, slightly plastic when wet; dark greenish-gray (5GY 4/1) and very dark gray (5Y 3/1) thin clay films on ped faces and in root channels; glauconite content 5 to 10 percent; abrupt, smooth boundary; horizon 0 to 10 inches thick.

Cg—32 to 60 inches, alternating layers of olive-gray (5Y 5/2) loamy sand and fine sandy loam and white (10YR 8/1) sand; many, coarse, prominent mottles of strong brown (7.5YR 5/6) and dark yellowish brown (10YR 4/4); loamy sand is single grain and loose; fine sandy loam is massive and very friable.

Shrewsbury soils contain varying amounts of rounded quartzose pebbles. These are most abundant in the upper part of the C horizon.

Unplowed soils have a very dark A1 horizon about 4 to 6 inches thick. When plowed, this horizon is destroyed and mixed with the horizon below to make the Ap horizon. The Ap horizon is 4 or 5 in value. The A2 horizon is 5Y or 10YR in hue, 5 or 6 in value, and 1 or 2 in chroma. The A2 texture is fine sandy loam, but it approaches loamy sand.

In some areas bog iron formed at a depth of 10 to 16 inches in place of the A2 horizon. Where the ironstone is extensive, the soil is mapped as an ironstone variant of the Shrewsbury series and is described separately.

The B horizon ranges from 12 to 24 inches in thickness. It is 5Y or 5GY in hue, 5 in value, and 1 or 2 in chroma. Mottles are mostly 10YR in hue, 5 or 6 in value, and 8 in chroma. The B horizon is either heavy fine sandy loam or fine sandy clay loam.

The C horizon normally is composed of alternating stratified layers of loamy sand, fine sandy loam, and sand.

Shrewsbury soils are mostly associated with Keansburg, Holmdel, and Adelphia soils. They normally are higher than Keansburg soils and lower than Holmdel and Adelphia soils. Shrewsbury soils lack the black surface layer common in the Keansburg soils and are grayer than the Holmdel and Adelphia soils. All of these soils contain glauconite. Shrewsbury soils appear to be like Fallsington soils because they

are both poorly drained. But Fallsington soils do not contain glauconite and do not occur with the glauconitic soils.

Shrewsbury fine sandy loam (Sn).—This soil has the profile described as typical for the series. Included with this soil in mapping are small areas of other Shrewsbury soils and of Keansburg, Holmdel, and Adelphia soils. Also included, north of Cookstown, are some small areas of loamy sand. Other small areas have a clay loam subsoil and slower drainage than this soil. In these areas underdrains may not provide adequate drainage.

Where it is used for crops, this soil needs drainage. Ditches or underdrains can be used to lower the water table. In places, however, the ground water contains so much iron that underdrains become cemented with it. Where the subsoil has the finest texture, surface drains may be needed in addition to deep drainage. (Capability unit IIIw-21; woodland suitability group 3w2)

Shrewsbury fine sandy loam, clayey substratum (So).—This soil has clay layers that generally occur at a depth of 40 to 60 inches but in places are only 30 inches below the surface. These clay layers are generally very dark and thick. Except for these layers, this soil has a profile similar to that described as typical for the series.

This soil has drainage needs similar to those of Shrewsbury fine sandy loam. Recharge rates in dug ponds are likely to be slow, and in places the water may be acid. (Capability unit IIIw-21; woodland suitability group 3w2))

Shrewsbury loam (Sp).—Except that it has a loam surface layer, this soil has a profile similar to that described as typical for the series. It warms more slowly in spring and cannot be worked so soon after rains as Shrewsbury fine sandy loam. It is subject to severe frost heave. In addition to deep drainage, surface drains may be needed. The surface can be drained by shaping or grading the small and irregular areas or by bedding in the more extensive areas.

Crops grown on this soil are mostly small grains, soybeans, corn, hay, and pasture. (Capability unit IIIw-20; woodland suitability group 3w2)

Shrewsbury sandy clay loam, truncated (Sv).—This soil is all that remains of the typical Shrewsbury soil after about a foot of the surface layer has been removed to be used elsewhere. Because of the higher clay content, the soil now at the surface is low in organic matter and is difficult to work. It is sticky when wet and becomes firm and hard when it dries. Runoff is moderate.

Most areas of this truncated soil are on Fort Dix military property. They are smoothed and fertilized and seeded with a mixture of perennial plants that serve as food and cover for wildlife. (Capability unit IIIw-20; woodland suitability group 3w2)

Shrewsbury Fine Sandy Loam, Ironstone Variant

The main difference between this soil and Shrewsbury fine sandy loam is the formation of an ironstone layer in the subsoil. The variant is nearly level and occurs in low positions where the water table is high.

In a typical profile the surface layer is dark-brown fine sandy loam about 10 inches thick. The subsoil extends to a depth of about 24 inches. The upper 8 inches is a strong-brown loam containing a few iron concretions, and the lower part is a yellowish-red ironstone layer. The substratum is stratified very dark gray or black loam or sandy loam.

This soil, though its water table rises more quickly in wet periods, is similar to Shrewsbury fine sandy loam in wetness. The ironstone layer restricts root development and thereby reduces the soil depth, available water capacity, and the productive capacity of the soil. Where the ironstone is continuous in large sheets, permeability is reduced.

Most of this soil is used for woodland, pasture, corn, and soybeans. Growth varies considerably from place to place, depending on the degree of cementation of the ironstone and the amount of drainage obtained. The ironstone makes the installation of drainage ditches and underdrains difficult.

Typical profile of Shrewsbury fine sandy loam, ironstone variant, in a cultivated field about 1¼ miles northeast of Georgetown adjacent to Blacks Creek:

Ap—0 to 10 inches, dark-brown (7.5YR 3/2) fine sandy loam; many, fine and medium, distinct mottles of dark reddish brown (5YR 3/3); weak, fine, granular structure; very friable; few, fine, angular iron concretions ⅛ to ¼ inch in diameter; glauconite content about 5 percent; abrupt, smooth boundary; horizon 6 to 12 inches thick.

B21t—10 to 18 inches, strong-brown (7.5YR 5/8) loam; common, medium, prominent mottles of greenish gray (5GY 5/1); moderate, medium, subangular blocky structure; friable, sticky and plastic when wet; few angular iron concretions; patchy clay films; glauconite content about 5 percent; abrupt, smooth boundary; horizon 0 to 18 inches thick.

B22m—18 to 24 inches, yellowish-red (5YR 4/8) ironstone that is strongly cemented or indurated and generally porous and discontinuous; between masses of the stone is yellowish-red (5YR 4/8) sandy loam that has common, medium, greenish-gray (5GY 5/1) mottles; very weak, medium, subangular blocky structure; friable; abrupt, smooth boundary; horizon 0 to 15 inches thick.

C1g—24 to 34 inches, very dark gray (N 3/0) loam; few, fine, prominent mottles of olive brown (2.5Y 4/4); massive and friable; micaceous; glauconite content about 5 percent.

C2g—34 to 45 inches, very dark gray (5G 4/1) sandy loam; massive and friable; micaceous, glauconite content 5 to 10 percent.

IIC3—45 to 60 inches, black (10YR 2/1) sandy loam; massive and friable; micaceous, glauconite content 5 to 10 percent.

The Ap horizon ranges from 10YR to 7.5YR in hue and from 2 to 5 in value.

The B horizon ranges from 7.5YR to 5YR in hue, is 4 or 5 in value, and ranges from 4 to 8 in chroma. The B horizon is loam, sandy loam, fine sandy loam, or fine sandy clay loam. The ironstone ranges from strongly cemented to indurated. In most places, however, it is discontinuous and may resemble a sieve with many holes. The ironstone is partly penetrated by roots. That the ironstone forms around the roots is indicated by an abundance of cemented tubes. The ironstone layer is about 6 inches thick. It commonly occurs just below the Ap horizon at a depth of 10 to 16 inches, but it is deeper in places. The ironstone occurs in more than 50 percent of the area.

The C horizon consists of stratified layers of several textures. The lower layers are commonly very dark, clayey, and more glauconitic than the soil above.

Shrewsbury fine sandy loam, ironstone variant, is associated mostly with other Shrewsbury soils and with Keansburg, Holmdel, and Adelphia soils. It can be distinguished from these soils by the ironstone layers.

Shrewsbury fine sandy loam, ironstone variant (Sx).—This soil has the profile described as typical for the variant. Included with this soil in mapping are other Shrewsbury soils and Keansburg, Holmdel, and Adelphia soils.

Drainage is needed if this soil is to be used for crops. Construction of fences and ditches and installation of underdrains are severely restricted by the ironstone in places. Root penetration is also restricted by the ironstone layer (fig. 23). (Capability unit IVw–21; woodland suitability group 3w2)

Tinton Series

The Tinton series consists of well-drained, gently sloping to strongly sloping soils having a thick sandy surface layer over a glauconitic fine sandy loam subsoil. Underlying layers are sand, fine sandy loam, and loamy sand. These soils form a narrow band, particularly on the south side of major west-flowing streams such as Rancocas Creek, where it appears that sand has been redeposited over glauconitic soils like the Freehold. Tinton soils are in high positions.

In a typical profile, the surface layer is grayish-brown sand about 12 inches thick and the subsurface layer is olive-yellow sand about 12 inches thick. The subsoil is olive-brown fine sandy loam about 14 inches thick. The substratum is stratified light olive-brown sand and fine sandy loam.

Permeability of Tinton soils is moderately rapid, and available water capacity is low or very low, depending on the depth of the sand. The surface soil is loose and subject to soil blowing. Organic-matter content and fertility are very low.

Figure 23.—Ironstone layer restricts root penetration and water movement in Shrewsbury fine sandy loam, ironstone variant.

The native vegetation is a hardwood forest consisting of mostly oaks, hickories, and Virginia pines. Virginia pines readily seed in idle fields and occupy the soil for some time before the hardwoods are again dominant.

About one-half of the acreage has been cleared for crops or for mining the subsoil for molding sand. Crops are restricted to pumpkins, cantaloups, grapes, peaches, and sweetpotatoes, but these do not grow well.

The Tinton soils warm early and can be worked immediately after heavy rains. In summer, crops may be scalded by the intense heat reflected from the sands. Irrigation is used in some areas. Fertilizers added to these soils leach readily. Fertilization should be frequent and in small amounts to decrease losses through leaching. Because these soils are very strongly acid, additions of lime are needed.

Typical profile of Tinton sand, 0 to 5 percent slopes, in a field 0.7 mile west of Madison Avenue, Mount Holly, 0.15 mile south of New Jersey Highway 38:

Ap—0 to 12 inches, grayish-brown (10YR 5/2) sand, very weak, fine, granular structure or single grain; very friable or loose; glauconite content low; abrupt, smooth boundary; horizon 10 to 14 inches thick.

A2—12 to 24 inches, olive-yellow (2.5Y 6/6) sand, single grain; loose; glauconite content low; gradual, smooth boundary; horizon 10 to 18 inches thick.

B2t—24 to 38 inches, olive-brown (2.5Y 4/4) fine sandy loam; moderate, coarse, subangular blocky structure; friable when moist; slightly sticky when wet; sand grains strongly stained and bridged; glauconite content 5 to 10 percent; clear boundary; horizon 10 to 30 inches thick.

C1—38 to 50 inches, light olive-brown (2.5Y 5/6) sand; single grain; loose; glauconite content low; gradual smooth boundary.

C2—50 to 60 inches, light olive-brown (2.5Y 5/4) fine sandy loam; massive; friable; glauconite content low.

The A horizon is sand consisting of a large amount of fine sand, but generally not enough to make a fine sand texture. It ranges from 20 inches to 32 inches in thickness. The Ap horizon is 10YR and 2.5Y in hue, 4 or 5 in value, and ranges from 2 to 4 in chroma. The A2 horizon is 5 or 6 in value and ranges from 4 to 6 in chroma.

The B2t horizon ranges from 10 to 30 inches in thickness. It is 2.5Y to 5YR in hue, 4 or 5 in value, and ranges from 4 to 6 in chroma. Lamellae, or banded horizons, are common either above or below the main part of the B2t horizon.

The C horizon consists of alternating sand, fine sandy loam, and loamy sand layers that are 2.5Y or 5Y in hue, are 5 or 6 in value, and range from 4 to 6 in chroma.

Tinton soils are associated mostly with Pemberton, Freehold, and Holmdel soils. Tinton soils lack the mottling common to Pemberton and Holmdel soils. They have a thicker A horizon than the Freehold soils. All of these associated soils contain small amounts of glauconite.

Tinton sand, 0 to 5 percent slopes (TsB).—This soil has the profile described as typical for the series. Included with this soil in mapping are small areas of the adjacent Freehold loamy sand.

Most of the cropland is used for irrigated fruits and vegetables, such as tomatoes, peaches, and grapes. Pumpkins also are grown. Many areas have reverted to woodland. If crops are grown, the extensive exposed areas need protection from soil blowing. Windbreaks, cover crops, or windstripping can be used for this pur-

pose. (Capability unit IIIs–6; woodland suitability group 3s1)

Tinton sand, 5 to 10 percent slopes (TsC).—Erosion is a hazard on this soil. Its profile is similar to that described as typical for the series. Included with this soil in mapping are small areas of Freehold loamy sand.

Where it is farmed, this soil needs to be protected from water erosion. The use of cover crops and contour farming are effective erosion control practices. (Capability unit IVs–7; woodland suitability group 3s1)

Tinton sand, thick surface, 0 to 5 percent slopes (TtB).—Except that it has a combined surface and subsurface layer about 35 inches thick, this soil has a profile similar to that described as typical for the series. The subsoil is about 14 inches thick in most places. Included with this soil in mapping are about 200 acres on the south side of Rancocas Creek near Highway 38 where the subsoil was removed 30 to 50 years ago to be used as molding sand. Large areas were left rough and had many piles of sand. The mounds, though somewhat rounded on top, are still visible. All of these areas have reverted to woodland and support stands of Virginia pine.

Although it is too droughty and infertile to be used extensively for crops, this soil is best suited to deep-rooted perennials such as grapes or peaches. Where it is cleared, this soil is subject to soil blowing. (Capability unit IVs–7; woodland suitability group 3s1)

Urban Land

This land type consists of cut and fill areas, most of which have been developed for residential, commercial, or industrial use or for multilane highways. During development, the original soil horizon was destroyed in at least 70 percent of the area.

Urban land, sandy (Ug).—Most of this land is developed or awaiting development. The soil has slight limitations for industrial or commercial use, moderate limitations for woodland or wildlife use, and severe limitations for farming and dug ponds.

Areas of both cut and fill are moderately or rapidly permeable. Where the original soil was removed and the substratum exposed, the material remaining is rapidly permeable and extremely low in organic-matter content and fertility. Where the material was moved from one area to another, permeability is generally moderate, but it is slow in places because of compaction by heavy equipment.

In Willingboro, the topsoil was stockpiled, roads were constructed, and utility lines were installed in excavated ditches. The landscape was then reshaped according to design and the topsoil replaced.

In a few small areas several feet of the original soil were removed and the area was smoothed for farming again. In these places, yields are about one-half of what they had been. (Capability and woodland suitability unclassified)

Urban land, clayey (Ut).—Fill areas of this land generally contain brown clayey material, most of which was obtained from areas that had been farmed and limed. A grass cover generally is not difficult to establish on fill areas.

Cut areas generally have exposed dark-gray clayey beds of the Merchantville or Woodbury clay Formations. This material is low in organic-matter content, is slowly permeable, is extremely acid, and is subject to severe frost heaving. Any kind of plant cover is difficult to establish.

This land type has severe limitations to use for wildlife ponds. (Capability and woodland suitability unclassified)

Urban land, sandy over clayey (Uv).—This land consisted of sandy layers that were 1 to 2 feet deep over clayey beds until the original profile was destroyed in much of the area. Where the sandy part remains, it is moderately permeable in most places and slowly permeable where it has been compacted by equipment. The underlying clayey material is slowly permeable. In places water is perched over the clayey material long enough to wet the basements. Where the remaining sandy material is thin, frost-free fill may be needed before paving the area.

In Willingboro, the sandy upper part of this land has been moved and the landscape reshaped. Where the sandy material has been removed, the clayey material is now at the surface. Because it is sticky when wet and hard when dry, a vegetative cover is difficult to obtain. (Capability and woodland suitability unclassified)

Westphalia Series

The Westphalia series consists of well-drained, nearly level or gently sloping, sandy and loamy soils. These soils formed in the thick Kirkwood marine deposit, which consisted mostly of very fine and fine sands. Some of these soils were transported by water or wind. They occur on high positions in the county.

In a typical profile, the surface layer is dark grayish-brown fine sandy loam about 10 inches thick and the subsurface layer is light olive-brown fine sandy loam about 3 inches thick. The yellowish-brown subsoil extends to a depth of 42 inches. It is very fine sandy loam in the upper 17 inches and fine sandy loam below. The substratum is stratified yellowish-brown fine sand and fine sandy loam. The sands contain small amounts of mica.

Probably because of the high percentage of uniformly fine sand, these soils are moderately slow in permeability. The available water capacity is high for the fine sandy loam and moderate for the loamy fine sand. Organic-matter content is moderate for the fine sandy loam and low for the loamy fine sand. Westphalia soils are moderately fertile.

In most places the native vegetation is a mixed hardwood forest consisting of northern red oak, southern red oak, scarlet oak, white oak, black oak, yellow-poplar, holly, beech, hickory, and scattered Virginia pine. In places yellow-poplar or beech grow in nearly pure stands. Virginia pine commonly seeds in idle fields and occupies the site for some time before the hardwoods become reestablished.

Most of this acreage has been cleared for crops. The

crops grown include corn, soybeans, small grains, pasture, hay, fruit, vegetables, nursery stock, and sod. Most high-value crops are irrigated.

Westphalia soils are easily worked, but they are subject to soil blowing. The loamy fine sands warm early. Westphalia soils are very strongly acid unless they have been limed, and fields need frequent additions of lime to prevent them from becoming that acid again. The substratum does not restrict root penetration, but few crop roots are found in it. Fertilizers added to these soils leach, but not rapidly.

Typical profile of Westphalia fine sandy loam in a rotational pasture 1.2 miles south of County Highway 530 at Pemberton:

Ap—0 to 10 inches, dark grayish-brown (2.5Y 4/2) fine sandy loam; very weak, fine, granular structure; very friable; abrupt, smooth boundary; horizon 8 to 12 inches thick.

A2—10 to 13 inches, light olive-brown (2.5Y 5/4) fine sandy loam; weak, fine to medium, granular structure; very friable; many fine and coarse pores; sand grains clean; clear, smooth boundary; horizon 0 to 9 inches thick.

B2t—13 to 30 inches, yellowish-brown (10YR 5/6) very fine sandy loam; weak, medium to coarse, subangular blocky structure; friable, slightly sticky and very slightly plastic when wet; numerous fine pores; thin, discontinuous, patchy clay films on peds; sand grains weakly bridged; slightly micaceous; clear, smooth boundary; horizon 8 to 18 inches thick.

B3—30 to 42 inches, yellowish-brown (10YR 5/4) light fine sandy loam; very weak, coarse, subangular blocky structure; very friable; slightly sticky when wet; small amounts of mica; clear, smooth boundary; horizon 0 to 12 inches thick.

C—42 to 60 inches, alternating layers of light yellowish-brown (2.5Y 6/4) fine sand and yellowish-brown (10YR 5/8) fine sandy loam; fine sand is single grain and loose; fine sandy loam is massive and friable; micaceous.

Westphalia soils contain varying amounts of rounded quartzose pebbles that are most abundant where glacial water has deposited material over the fine sand or where fine sands have been redeposited. The solum ranges from 24 to 45 inches in thickness.

Wooded soils have a very dark A1 horizon that is about 4 inches thick and that contains large amounts of organic matter. Some areas of loamy fine sand have a 1- to 3-inch gray upper A2 horizon below the A1 horizon. These two horizons are mixed with some of the lower part of the A2 horizon when the soil is plowed, and an Ap horizon is formed. The Ap horizon is fine sandy loam or loamy fine sand. It is 2.5Y or 10YR in hue and 3 or 4 in value. The A2 horizon also is fine sandy loam or loamy fine sand. It is 2.5Y or 10YR in hue, 5 or 6 in value, and ranges from 3 to 6 in chroma.

The B2t and B3 horizons are 10YR or 7.5YR in hue, 5 or 6 in value, and range from 4 to 8 in chroma. Reddish hues and high chromas are common when the soils are in high positions where they are well oxidized. The clay content of the B2t horizon is 5 to 10 percent higher than in the A horizon, and the difference is greatest in the loamy sand. The silt content of both the A and B horizons is 11 to 13 percent. In the B horizons, the content of very fine sand ranges from 35 to 45 percent and fine sand ranges from 27 to 38 percent.[2]

The C horizon is 2.5Y or 10YR in hue and ranges from 5 to 7 in value. In most places the C horizon ranges from 4 to 8 in chroma, but chroma is lower near the water table.

Westphalia soils are associated with Nixonton, Freehold, and Holmdel soils. Westphalia soils lack the mottling of the Nixonton and Holmdel soils and the glauconite of the Freehold soils.

[2] Texture analysis summaries for six Westphalia soils sampled in Gloucester, Camden, and Burlington Counties, N.J.

Westphalia loamy fine sand, 0 to 2 percent slopes (WaA).—Except that it has a loamy fine sand surface layer about 16 inches thick, this soil has a profile similar to that described as typical for the series. Included with this soil in mapping are some small areas of Nixonton, Freehold, and Holmdel soils and some soils that have slopes of more than 2 percent.

Because it warms early, this soil is suited to early vegetables. It is subject to soil blowing, which can be reduced by the use of cover crops, windbreaks, or windstripping. (Capability unit IIs–6; woodland suitability group 2o1)

Westphalia loamy fine sand, 2 to 5 percent slopes (WaB).—Runoff is moderate on this soil. Except that the surface layer is loamy fine sand about 16 inches thick, this soil has a profile similar to that described as typical for the series. Included with this soil in mapping are small areas of Westphalia fine sandy loam and of Freehold soils.

In addition to the hazard of soil blowing, water erosion is a moderate hazard. It can be controlled by contour farming and use of cover crops. (Capability unit IIs–6; woodland suitability group 2o1)

Westphalia fine sandy loam, 0 to 2 percent slopes (WdA).—This soil has the profile described as typical for the series. Included with this soil in mapping are small areas of Westphalia loamy fine sand and Nixonton, Freehold, and Holmdel soils.

This soil is well suited to all crops grown in the county, including general crops, fruit, vegetables, nursery stock, and sod. High-value crops generally are irrigated. (Capability unit I–5; woodland suitability group 2o1)

Westphalia fine sandy loam, 2 to 5 percent slopes (WdB).—Runoff and the hazard of erosion are moderate. This soil is similar to that described as typical for the series. Included with this soil in mapping are small areas of Westphalia loamy fine sand and of Nixonton and Freehold soils.

This soil, though suited to the same kinds of crops as Westphalia fine sandy loam, 0 to 2 percent slopes, needs some protection against erosion. Cover crops, stripcropping, and terraces are used for that purpose. (Capability unit IIe–5; woodland suitability group 2o1)

Woodmansie Series

The Woodmansie series consists of well-drained soils that have a bleached sand subsurface layer and a finer textured mostly sandy loam subsoil. The substratum is generally loose sand. These soils are mainly nearly level to gently sloping, but a small acreage has slopes of 5 to 10 percent. Woodmansie soils formed mostly on high positions, especially those above 150 feet in elevation. In most places they formed on Beacon Hill gravel.

In a typical profile, the surface layer is dark-gray sand about 2 inches thick and the subsurface layer is gray sand about 6 inches thick. The subsoil extends to

a depth of 30 inches. It is light yellowish-brown sand in the upper 9 inches and yellowish-brown sandy loam below. The substratum is stratified yellow sand and reddish-yellow sandy loam.

Permeability of these soils is moderately rapid, except that it is moderately slow in the substratum in some places. The available water capacity is low, and excess water is rarely in the profile. Because the surface layer is bleached, organic-matter content is low and fertility probably is low. Since Woodmansie soils are not cultivated, fertility can only be deduced. Forest stands are so severely damaged by wildfires, that they do not reliably indicate soil fertility.

The native vegetation is believed to have been a hardwood forest consisting mostly of black oak, white oak, scarlet oak, chestnut oak, and hickory and a scattering of pitch pine, shortleaf pine, and Virginia pine. Because Woodmansie soils occupy high positions and nearly all wildfires burn the hilltops, the dominant vegetation is now mostly pitch pine, scrub oak, and blackjack oak. Where wildfires have been very severe, the trees are dwarfed to less than 5 feet high, though they may be more than 50 years old. Pines seed readily where these soils are left bare.

Woodmansie soils are not so well suited to crops as the Downer soils but are better suited than the Lakewood and Evesboro soils. If cleared, Woodmansie soils would warm early in spring. Added fertilizers would leach, but not so rapidly as in the Lakewood and Evesboro soils. On Woodmansie soils in their present condition, only grasses that withstand low fertility can survive. These soils are very strongly acid.

Typical profile of Woodmansie sand, in a forested area 0.2 mile west of Burlington and Ocean County line on New Jersey Highway No. 72 and 0.4 mile southwest on sand road:

A1—0 to 2 inches, dark-gray (N 4/0) sand; single grain; loose; less than 1 percent fine rounded quartz pebbles; very strongly acid; abrupt, smooth boundary; horizon 0 to 3 inches thick.

A2—2 to 8 inches, gray (10YR 6/1) sand; single grain; loose; 1 percent fine rounded quartzose pebbles; very strongly acid; clear, wavy boundary; horizon 5 to 10 inches thick.

B1—8 to 17 inches, light yellowish-brown (10YR 6/4) sand; single grain; loose; 2 percent rounded quartzose pebbles; very strongly acid; abrupt, smooth boundary; horizon 8 to 10 inches thick.

B2t—17 to 30 inches, yellowish-brown (10YR 5/6) sandy loam; weak, fine and medium, subangular blocky structure; very friable when moist; slightly sticky when wet; sand grains bridged with clay; 3 percent fine and coarse rounded quartzose pebbles; very strongly acid; gradual, smooth boundary; horizon 12 to 15 inches thick.

C1—30 to 45 inches, yellow (2.5Y 8/6) coarse sand; single grain; loose; very strongly acid; gradual, smooth boundary.

C2—45 to 60 inches, reddish-yellow (7.5YR 6/6) sandy loam; massive; friable; very strongly acid.

Woodmansie soils contain quartzose pebbles that range from a small amount to almost 50 percent of any horizon. In places a thin, discontinuous, brown (10YR 4/3) horizon is in the upper part of the subsoil. In places the B2t horizon is reddish and firm and contains gravel and clay. The available water capacity varies considerably, depending on the thickness of the firm and loamy substratum.

Woodmansie soils are associated with Lakehurst, Lakewood, and Downer soils. Woodmansie soils lack the mottling of Lakehurst soils and are finer textured in the subsoil than Lakewood soils. They resemble the Downer soils but are more deeply bleached.

Woodmansie sand, 0 to 5 percent slopes (WeB).—This soil has the profile described as typical for the series. Included with this soil in mapping are small areas of normally associated Lakehurst, Lakewood, and Downer soils. The Lakehurst soils are in intermediate positions. Also included are small areas that have slopes of more than 5 percent and small areas of Woodmansie soils that have a firm substratum.

In places the subsoil is heavy sandy loam or sandy clay loam. In these areas the soil has a higher available water capacity and slower permeability than the typical soil. All areas of this Woodmansie soil are woodland and need to be protected from wildfires. (Capability unit IVs–8; woodland suitability group 4s1)

Woodmansie sand, 5 to 10 percent slopes (WeC).—Where this soil is cleared, runoff is rapid and the hazard of erosion is severe. This soil has a profile similar to that described as typical for the series. Included with this soil in mapping are areas of Lakewood and Downer soils. (Capability unit IVs–8; woodland suitability group 4s1)

Woodmansie sand, firm substratum, 2 to 5 percent slopes (WgB).—This soil has a firm substratum that begins in most places at a depth of about 24 inches and extends to 50 inches or more. The substratum ranges from yellowish brown (10YR 5/4) to yellowish red (5YR 5/8). It is heavy sandy clay loam or gravelly sandy clay loam in the upper part, but this layer contains enough clay to be moderately slow in permeability. Beneath it the soil is sandier and permeability is more rapid. Except for the substratum, this soil has a profile similar to that described as typical for the series.

Nearly all areas of this soil are forested and need protection from wildfires. In places the substratum is a source of rounded quartzose gravel. (Capability unit IVs–8; woodland suitability group 4s1)

Woodmansie sand, loamy substratum, 0 to 5 percent slopes (WhB).—This soil has a loamy substratum that generally occurs at a depth of 40 to 60 inches and in some places is as close to the surface as 30 inches. This substratum is sandy clay loam in most places, but in some places it is sandy clay or clay. Except for the substratum, this soil has a profile similar to that described as typical for the series.

The available water capacity of this soil is higher than for the typical soil, but only deep-rooted plants benefit. Water may move laterally over the loamy substratum.

Nearly all areas of this soil are woodland and need protection against wildfires. (Capability unit IVs–8; woodland suitability group 4s1)

Woodstown Series

The Woodstown series consists of moderately well drained, sandy and loamy soils that are nearly level or gently sloping. These soils are nearly level in about 70 percent of the acreage. They formed in water-laid ma-

terial and generally occur below Sassafras and above Fallsington soils. Woodstown soils have a fluctuating water table that rises to a depth of about 2 feet late in winter.

In a typical profile, the surface layer is dark grayish-brown fine sandy loam about 10 inches thick and the subsurface layer is light olive-brown fine sandy loam about 4 inches thick. The subsoil is yellowish-brown mottled fine sandy loam about 20 inches thick. The substratum is stratified light yellowish-brown sand and yellowish-brown loamy sand.

Woodstown soils have moderately slow or moderate permeability and moderate available water capacity. When rainfall is normal, the water table starts to rise in October, reaches its peak of about 2 feet from the surface late in winter, and drops again to a depth of more than 5 feet in summer. In drained areas the water table rises to about 2 feet from the surface only after heavy rains, and then it drops rapidly. Organic-matter content is moderate or low, depending on the texture of the surface layer. The loamy soils are moderate in fertility, and the sandy soils are moderately low.

Irrigation is needed for high-value crops. These soils can be drained by open ditches or underdrains. Although Woodstown soils are naturally very strongly acid, in heavily limed farmed fields acidity has been reduced.

Typical profile of Woodstown fine sandy loam, 0 to 2 percent slopes, in a cultivated field 0.2 mile north of Fairview-Hartford Road and 0.8 mile east of Bridgeboro-Moorestown Road:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, medium, granular structure; very friable; many fine and medium pores; about 1 percent rounded quartzose pebbles as much as 2 inches in diameter; abrupt, smooth boundary; horizon 8 to 12 inches thick.

A2—10 to 14 inches, light olive-brown (2.5Y 5/4) fine sandy loam; weak, medium, granular structure; friable; many fine pores; sand grains clean; clear, smooth boundary; horizon 4 to 8 inches thick.

B1—14 to 24 inches, yellowish-brown (10YR 5/6) heavy fine sandy loam; few, fine, faint mottles of strong brown (7.5YR 5/8); weak, coarse, subangular blocky structure; friable, slightly sticky and slightly plastic when wet; many fine and a few coarse pores; sand grains stained; gradual, smooth boundary; horizon 2 to 14 inches thick.

B2t—24 to 34 inches, yellowish-brown (10YR 5/6) heavy fine sandy loam; common, fine and medium, dark-brown (7.5YR 4/4) mottles in the upper half of horizon and few to many, medium and coarse, distinct, dark-brown (7.5YR 4/2) mottles in the lower half; weak, medium and coarse, subangular blocky structure; friable, slightly sticky when wet; many fine pores; sand grains weakly bridged; few spheroidal iron concretions ⅛ to ¼ inch in diameter in the lower 4 inches; few rounded quartzose pebbles in lower few inches; gradual, smooth boundary; horizon 8 to 14 inches thick.

C—34 to 60 inches, alternating layers of light yellowish-brown (2.5Y 6/4) sand and yellowish-brown (10YR 5/6) loamy sand; single grain and massive; loose and very friable; about 5 percent rounded quartzose pebbles as much as 2 inches in diameter.

In this county Woodstown soils normally contain some rounded quartzose pebbles. These pebbles generally are most abundant in the C horizon, but in most places small amounts may occur in any horizon.

The A1 horizon is commonly about 4 inches thick, and the bleached gray A2 horizon is 2 to 4 inches thick. The A1 and A2 horizons are destroyed and mixed with some of the underlying A2 horizon when the soil is plowed. In undisturbed areas the underlying A2 horizon is 7 or more inches thick, but it is reduced to 4 inches where the soil is plowed. The Ap horizon is 4 or 3 in value and 2 or 3 in chroma. The A2 horizon is 2.5Y or 10YR in hue.

The B horizon ranges from heavy sandy loam to light sandy clay loam in texture and from 10 to 24 inches in thickness. It is generally thin in the outer Coastal Plain but is thicker in the inner Coastal Plain. Mottles in the B horizon are 2.5Y or 7.5YR in hue, 5 or 4 in value, and range from 2 to 8 in chroma.

In most places the C horizon is stratified sand or loamy sand and sandy loam containing varying amounts of rounded quartzose pebbles. In places the underlying layers range from loam to clay, and where these areas were extensive they were mapped separately.

Woodstown soils generally are associated with Sassafras and Fallsington soils. Mottling in Woodstown soils distinguishes them from the Sassafras. Woodstown soils are not so gray as the Fallsington. Woodstown soils resemble Holmdel and Adelphia soils but lack the glauconite that is commonly in those soils.

Woodstown loamy sand, 0 to 2 percent slopes (WkA).—This soil occurs mostly in the outer Coastal Plain. Except that the surface layer is loamy sand about 18 inches thick and the subsoil is sandy loam about 12 inches thick, the profile of this soil is similar to that described as typical for the series. Included with this soil in mapping are small areas of Klej, Sassafras, and Fallsington soils.

Where it is adequately drained, this soil is suited to fruit, vegetables, and general crops. Because of moderately low fertility and available water capacity, this soil is not well suited to general crops that grow through the summer when only a small amount of water is available.

Underdrains or open ditches can be used to lower the water table. Deep drainage is more effective in reducing the water table than is land filling. Extensive exposed fields need to be protected from soil blowing by cover crops, windbreaks, or windstripping. High-value crops need irrigation. (Capability unit IIIw–15; woodland suitability group 2w1)

Woodstown loamy sand, loamy substratum, 0 to 2 percent slopes (WlA).—Except that it has a loamy sand surface layer and a loamy substratum at a depth of 40 to 60 inches, this soil has a profile similar to that described as typical for the series. In most places the substratum ranges from loam to clay loam; in a few places it is as fine textured as sandy clay or clay. In most places the substratum is not thick.

Where drained, this soil is suited to fruit, vegetables, and general crops. Drainage is needed for good crop growth. Because of the loamy substratum, the water table rises rapidly. Underdrains or open ditches can be used to lower the water table. Extensive exposed fields need to be protected against soil blowing by use of cover crops, windbreaks, or windstripping. (Capability unit IIIw–15; woodland suitability group 2w1)

Woodstown fine sandy loam, 0 to 2 percent slopes (WmA).—This soil has the profile described as typical for the series. Included with this soil in mapping are

small areas of Sassafras and Fallsington soils. Also included are small areas that have a clayey substratum.

Drainage is needed for best crop growth. Open ditches or underdrains can be used to lower the water table, though most of the underdrains installed long ago are not deep enough. Where it is adequately drained, this soil is suited to most crops grown in the area. It cannot be cultivated early, and it may be saturated for short periods during extremely heavy rains. Where this soil is used for a homesite, underdrains are needed around the foundation and under the basement floor. (Capability unit IIw–14; woodland suitability group 2w1)

Woodstown fine sandy loam, 2 to 5 percent slopes (WmB).—This soil has a profile similar to that described as typical for the series. Included with this soil in mapping are small areas of Sassafras and Freehold soils and of Woodstown soils with a clayey substratum. Small areas have slopes of more than 5 percent.

Except that protection against erosion is also needed, this soil is used and managed in about the same way as Woodstown fine sandy loam, 0 to 2 percent slopes. Interceptor underdrains can be used in many places. (Capability unit IIw–14; woodland suitability group 2w1)

Woodstown fine sandy loam, clayey substratum, 0 to 2 percent slopes (WnA).—The clayey substratum of this soil is at a depth of 40 to 60 inches in most places. In some places, however, the substratum is at a depth of only 30 inches, and in these places there is only a thin sandy layer in the substratum or the sandy layer is absent. The substratum is mostly clay, silty clay, or heavy clay loam. Except for this substratum, this soil has a profile similar to that described as typical for the series. The substratum generally is part of the Merchantville or Woodbury clay Formations. In most places it is very dark gray and thick, but in many small areas the substratum is gray, an indication that it has been saturated for extended periods. This soil generally occurs in high positions.

Because of the underlying clay, ground water rises so rapidly in this soil during heavy rains that a temporary perched water table is formed. In summer when rainfall is normal, there is no excess water in this soil.

The use and management of this soil is similar to that of Woodstown fine sandy loam, 0 to 2 percent slopes, except that the design and installation of underdrains are more difficult. Also, this soil is not so suitable as a site for dug ponds. The recharge rate is slow, because of the underlying clayey layer, and in places this layer makes the water so acid that fish cannot reproduce. The clay, however, increases the available water capacity. (Capability unit IIw–14; woodland suitability group 2w1)

Woodstown fine sandy loam, clayey substratum, 2 to 5 percent slopes (WnB).—This soil is similiar to Woodstown fine sandy loam, clayey substratum, 0 to 2 percent slopes, except that erosion is a hazard and drainage is more difficult.

Interceptor underdrains can be used on this soil in many places. Cover crops, stripcropping, or terraces can be used to control erosion. (Capability unit IIw–14; woodland suitability group 2w1)

Use and Management of the Soils

This section is designed to help the landowner understand how soils behave and how they can be used. Estimated yields of principal crops under ordinary and improved management are given in table 2. Next the system of capability classification used by the Soil Conservation Service is briefly described. Those who wish to know the capability classification of a given soil can refer to the "Guide to Mapping Units" at the back of this survey. Those who want information about management of the soil can refer to the section "Descriptions of the Soils."

The rest of this section discusses the use of soils in wildlife and woodland management; in building highways, ponds, and other engineering structures; and in community development.

Estimated Yields

The estimated index, or yield rating, for the principal crops grown in Burlington County is given for two levels of management in table 2. Ratings range from 1, indicating the lowest yields, to 10, indicating the highest. The index figures, or ratings, are converted to estimated acre yields in table 3. Soils and land types not commonly used for crops are not listed in table 2.

The ratings are averages that can be expected in a period of several years, not a maximum yield in a favorable season. Yields in any one year may be affected by many factors, including favorable or unfavorable weather, insects, and plant diseases.

The ratings in columns A indicate the yields expected under management used by most farmers in the county. Under such management, not enough lime or fertilizer is used. On some farms practices of erosion control, drainage, and irrigation are inadequate. Farmers do not use improved varieties of crops and certified seed, and the seedbed is not prepared properly. Insects and diseases are not well enough controlled.

The ratings in columns B indicate the yields expected under improved or the best current management. Comparison of the ratings in columns B with those in A show the response to be expected when management is improved to the highest level attainable. Under such management, (1) enough lime and commercial fertilizer are applied; (2) drainage, where needed, is adequate; (3) tomatoes are irrigated; (4) runoff and erosion are controlled; (5) seedbeds are properly prepared; (6) suitable crops and seed varieties are used; (7) cover crops and cropping systems are used that maintain a favorable soil structure; (8) weeds, insects, and plant diseases are controlled.

TABLE 2.—*Yield ratings of princpal crops under two levels of management*

[Ratings range from 1, indicating the lowest yields, to 10 indicating the highest. The ratings are converted to yields in table 3. Ratings in columns A are expected under management commonly used; those in columns B are expected under optimum current management. Absence of data indicates crop is not generally grown on the soil. Ratings for apples and peaches are good, fair, or poor]

Soil	Tomatoes		Corn		Alfalfa		Wheat		Soybeans		Apples	Peaches
	A	B	A	B	A	B	A	B	A	B		
Adelphia fine sandy loam, 0 to 2 percent slopes	7	9	5	8	8	10	8	9	7	10	Good	Fair.
Adelphia fine sandy loam, 2 to 5 percent slopes	7	9	5	8	8	10	8	9	7	10	Good	Fair.
Adelphia fine sandy loam, clayey substratum, 0 to 2 percent slopes	7	9	5	8	8	10	8	9	7	10	Good	Poor.
Adelphia fine sandy loam, clayey substratum, 2 to 5 percent slopes	7	9	5	8	8	10	8	9	7	10	Good	Poor.
Adelphia loam, 0 to 2 percent slopes	7	9	5	8	8	10	8	9	7	10	Good	Fair.
Adelphia sandy clay loam, truncated	--	--	--	6	--	8	--	7	--	8	Poor	Poor.
Adelphia fine sandy loam, glauconitic variant, 0 to 2 percent slopes	7	9	5	8	8	10	8	9	7	10	Good	Poor.
Adelphia fine sandy loam, glauconitic variant, 2 to 5 percent slopes	7	9	5	8	8	10	8	9	7	10	Good	Poor.
Colemantown loam	--	--	2	8	--	--	--	--	4	8	------	
Collington fine sandy loam, 0 to 2 percent slopes	8	10	6	9	8	10	7	9	7	10	Good	Good.
Collington fine sandy loam, 2 to 5 percent slopes	8	10	6	9	8	10	7	9	7	10	Good	Good.
Collington fine sandy loam, 5 to 10 percent slopes	7	9	6	9	7	10	7	8	6	9	Good	Good.
Collington loam, 0 to 2 percent slopes	8	9	6	9	8	10	8	9	7	10	Good	Fair.
Collington loam, 2 to 5 percent slopes	8	9	6	9	8	10	8	9	7	10	Good	Fair.
Donlonton fine sandy loam, 0 to 3 percent slopes	4	8	6	8	6	9	7	8	7	9	Fair	
Donlonton loam, 0 to 3 percent slopes	4	8	7	8	8	10	7	8	7	9	Fair	
Downer loamy sand, 0 to 2 percent slopes	3	5	3	5	3	4	4	6	4	6	Fair	Fair.
Downer loamy sand, 2 to 5 percent slopes	3	5	3	5	3	4	4	6	4	6	Fair	Fair.
Downer loamy sand, 5 to 10 percent slopes	2	4	2	4	2	3	5	6	3	5	Fair	Fair.
Downer loamy sand, gravelly substratum, 0 to 5 percent slopes	3	5	2	5	2	4	6	7	4	6	Fair	Fair.
Downer loamy sand, loamy substratum, 0 to 2 percent slopes	4	6	3	5	3	4	6	7	4	6	Fair	Fair.
Downer sandy loam, truncated, 0 to 5 percent slopes	--	4	--	3	--	3	--	5	--	5	Fair	Fair.
Evesboro sand, 0 to 5 percent slopes	--	--	--	--	--	--	3	4	--	--	Poor	Poor.
Evesboro sand, 5 to 10 percent slopes	--	--	--	--	--	--	3	4	--	--	Poor	Poor.
Evesboro sand, loamy substratum, 0 to 5 percent slopes	--	--	--	--	--	--	3	5	3	5	Poor	Poor.
Evesboro fine sand, 0 to 5 percent slopes	--	--	--	--	--	--	2	4	5	7	Poor	Poor.
Fallsington fine sandy loam	2	6	3	7	--	6	--	--	5	8	------	
Fallsington fine sandy loam, clayey substratum	2	6	3	7	--	6	--	--	5	8	------	
Freehold fine sandy loam, 0 to 2 percent slopes	6	9	6	9	8	10	7	8	7	10	Good	Good.
Freehold fine sandy loam, 2 to 5 percent slopes	6	9	6	9	8	10	7	8	7	10	Good	Good.
Freehold fine sandy loam, 5 to 10 percent slopes	5	8	5	8	7	9	6	8	6	9	Good	Good.
Freehold fine sandy loam, 10 to 15 percent slopes	--	--	4	7	6	8	5	7	--	--	Good	
Freehold fine sandy loam, clayey substratum, 2 to 5 percent slopes	6	9	6	9	8	10	7	8	7	10	Good	Good.
Freehold loamy sand, 0 to 5 percent slopes	5	7	4	7	6	8	6	7	5	8	Fair	Good.
Freehold loamy sand, 5 to 10 percent slopes	4	6	4	7	5	7	5	6	4	7	Fair	Good.
Freehold sandy loam, 5 to 10 percent slopes, severely eroded	3	5	3	5	4	6	3	5	3	6	Fair	Fair.
Freehold sandy loam, 10 to 15 percent slopes, severely eroded	2	4	2	4	2	5	3	5	--	--	Fair	Poor.
Galestown sand, 0 to 5 percent slopes	3	5	2	3	2	4	3	4	--	--	Poor	Fair.
Galestown sand, clayey substratum, 0 to 5 percent slopes	3	5	2	3	2	4	3	4	--	--	Poor	Fair.
Holmdel fine sandy loam, 0 to 2 percent slopes	4	7	5	8	8	10	8	9	7	10	Good	Good.
Holmdel fine sandy loam, 2 to 5 percent slopes	4	7	5	8	8	10	8	9	7	10	Good	Good.
Holmdel loamy sand, 0 to 5 percent slopes	4	6	4	7	6	8	5	7	5	8	Good	Good.
Holmdel fine sandy loam, clayey substratum, 0 to 2 percent slopes	3	7	5	8	8	10	8	9	7	10	Good	Good.
Holmdel fine sandy loam, clayey substratum, 2 to 5 percent slopes	5	7	4	8	8	10	8	9	7	10	Good	Good.
Keansburg fine sandy loam	--	--	--	6	--	--	--	--	3	7	------	
Keyport loamy sand, 0 to 5 percent slopes	3	6	4	7	5	7	4	6	4	7	Poor	
Keyport fine sandy loam, 2 to 5 percent slopes	3	6	4	7	6	8	5	7	5	8	Poor	
Keyport loam, 0 to 2 percent slopes	2	5	4	7	5	8	5	8	5	8	Poor	
Keyport loam, 2 to 5 percent slopes	2	5	5	8	6	8	6	8	6	9	Poor	
Keyport loam, 5 to 10 percent slopes	2	4	4	7	5	8	6	7	5	8	Poor	
Keyport loam, 10 to 15 percent slopes	--	--	--	--	4	7	--	--	--	--	------	
Klej sand, 0 to 4 percent slopes	3	5	2	6	--	--	--	--	4	7	Fair	Fair.
Klej sand, loamy substratum, 0 to 2 percent slopes	3	5	2	6	--	--	--	--	4	7	Fair	Fair.
Klej fine sand, 0 to 2 percent slopes	3	5	2	6	--	--	--	--	4	7	Fair	Fair.
Kresson loamy sand, 0 to 3 percent slopes	3	5	2	5	5	8	6	7	5	8	Poor	
Kresson fine sandy loam, 0 to 3 percent slopes	2	6	4	7	5	8	5	7	5	8	Poor	
Kresson loam, 0 to 3 percent slopes	2	5	4	8	6	9	5	7	5	8	Poor	
Marlton fine sandy loam, 0 to 2 percent slopes	4	6	4	7	6	8	5	7	5	8	Poor	
Marlton fine sandy loam, 2 to 5 percent slopes	4	6	4	7	6	8	6	7	5	8	Poor	
Marlton soils, 5 to 10 percent slopes	3	5	3	6	5	8	5	7	4	7	Poor	
Nixonton fine sandy loam, 0 to 2 percent slopes	4	7	4	7	6	8	8	9	7	10	Good	Good.

TABLE 2.—*Yield ratings of principal crops under two levels of management*—Continued

Soil	Tomatoes A	Tomatoes B	Corn A	Corn B	Alfalfa A	Alfalfa B	Wheat A	Wheat B	Soybeans A	Soybeans B	Apples	Peaches
Nixonton fine sandy loam, 2 to 5 percent slopes	4	7	3	8	6	8	8	9	7	10	Good	Good.
Nixonton loamy fine sand, 0 to 2 percent slopes	3	6	4	7	6	8	6	7	5	8	Good	Good.
Nixonton loamy fine sand, 2 to 5 percent slopes	3	6	3	7	6	8	6	7	5	8	Good	Good.
Pasquotank fine sandy loam	--	5	3	7	--	--	--	--	4	8	------	
Pemberton sand, 0 to 5 percent slopes	2	5	1	3	4	6	3	6	3	6	Poor	Poor.
Pemberton sand, thick surface, 0 to 5 percent slopes	2	4	1	3	3	5	3	6	3	6	Poor	Poor.
Pocomoke fine sandy loam	--	4	3	7	--	--	--	--	3	7	------	
Sassafras loamy sand, 0 to 5 percent slopes	4	6	4	7	6	8	5	7	5	8	Fair	Good.
Sassafras fine sandy loam, 0 to 2 percent slopes	5	8	5	8	8	10	7	8	7	10	Good	Good.
Sassafras fine sandy loam, 2 to 5 percent slopes	5	8	5	8	8	10	7	8	7	10	Good	Good.
Sassafras fine sandy loam, 5 to 10 percent slopes	4	7	4	7	8	10	7	8	6	9	Good	Good.
Sassafras fine sandy loam, clayey substratum, 0 to 2 percent slopes	5	8	5	8	8	10	7	8	7	10	Fair	Fair.
Sassafras fine sandy loam, clayey substratum, 2 to 5 percent slopes	5	8	5	8	8	10	7	8	7	10	Fair	Fair.
Shrewsbury fine sandy loam	3	6	3	7	--	--	--	--	4	8	------	
Shrewsbury fine sandy loam, clayey substratum	3	6	3	7	--	--	--	--	4	8	------	
Shrewsbury loam	2	5	4	8	--	--	--	--	4	8	------	
Shrewsbury sandy clay loam, truncated	--	4	--	7	--	--	--	--	--	7	------	
Shrewsbury fine sandy loam, ironstone variant	2	5	2	6	--	--	--	--	3	7	------	
Tinton sand, 0 to 5 percent slopes	3	5	--	--	--	--	3	5	3	6	Poor	Poor.
Tinton sand, 5 to 10 percent slopes	2	4		--	--	--	3	5	3	6	Poor	Poor.
Tinton sand, thick surface, 0 to 5 percent slopes	--	--	--	--	--	--	2	4	2	5	Poor	Poor.
Westphalia loamy fine sand, 0 to 2 percent slopes	5	7	4	7	6	8	6	7	5	8	Good	Good.
Westphalia loamy fine sand, 2 to 5 percent slopes	5	7	4	7	6	8	6	7	5	8	Good	Good.
Westphalia fine sandy loam, 0 to 2 percent slopes	5	8	6	9	8	10	8	9	7	10	Good	Good.
Westphalia fine sandy loam, 2 to 5 percent slopes	5	8	6	9	8	10	8	9	7	10	Good	Good.
Woodstown loamy sand, 0 to 2 percent slopes	3	6	3	8	6	7	4	6	5	7	Good	Good.
Woodstown loamy sand, loamy substratum, 0 to 2 percent slopes	3	6	3	8	6	7	4	6	5	7	Good	Good.
Woodstown fine sandy loam, 0 to 2 percent slopes	4	7	4	9	8	9	7	8	7	9	Good	Good.
Woodstown fine sandy loam, 2 to 5 percent slopes	4	7	4	9	8	9	7	8	7	9	Good	Good.
Woodstown fine sandy loam, clayey substratum, 0 to 2 percent slopes	4	7	4	9	8	10	7	8	7	9	Fair	Fair.
Woodstown fine sandy loam, clayey substratum, 2 to 5 percent slopes	4	7	4	9	8	10	7	8	7	9	Fair	Fair.

TABLE 3.—*Conversion of ratings given in table 2 to yields per acre* [1]

Rating	Crop				
	Tomatoes	Corn	Alfalfa	Wheat	Soybeans
	Tons	*Bu.*	*Tons*	*Bu.*	*Bu.*
1	8	50	1.0	10	5
2	10	60	1.5	15	10
3	12	70	2.0	20	15
4	14	80	2.5	25	20
5	16	90	3.0	30	25
6	18	100	3.5	35	30
7	20	110	4.0	40	35
8	22	120	4.5	45	40
9	24	130	5.0	50	45
10	26+	140+	5.5+	55+	50+

[1] Yield estimates prepared by interstate coordination in 1969.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, blueberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, so shallow, or otherwise so limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes, there can be as many as four subclasses. The subclass is in-

dicated by adding a small letter, *e*, *w*, *s*, or *c* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing cover is maintained; *w* means that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that use of the soil is limited mainly because the soil is shallow, droughty, or stony; and *c*, used in some parts of the United States but not in Burlington County, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, woodland, wildlife, or recreation.

Within the subclass are the capability units, which are groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to be similar in productivity and other responses to management. The capability unit is a convenient grouping for making many statements about the management of soils. Capability units generally are identified by numbers assigned locally, for example IIe-1 or IIIe-2.

The eight classes in the capability system and the subclasses and units in Burlington County are described in the list that follows. The unit designation for each soil in the county can be found in the "Guide to Mapping Units." The numbers for capability units in Burlington County are assigned according to a system used for the whole Coastal Plain geologic province, and therefore the numbering of units is not consecutive in the county.

Class I. Soils that have few limitations that restrict their use.
- (No subclasses.)
  - Capability unit I-4.—Deep, nearly level, well-drained soils with loam surface texture.
  - Capability unit I-5.—Deep, nearly level, well-drained soils with fine sandy loam surface texture.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
- Subclass IIe. Soils subject to moderate erosion if they are not protected.
  - Capability unit IIe-1.—Deep, slowly permeable, moderately well drained, gently sloping soils.
  - Capability unit IIe-2.—Deep, slowly permeable, well-drained, gently sloping soils with a fine sandy loam surface layer.
  - Capability unit IIe-3.—Deep, slowly permeable, well-drained, gently sloping soils with a loamy sand surface layer.
  - Capability unit IIe-4.—Deep, moderately permeable, well-drained, gently sloping soils with a fine sandy loam surface layer.
  - Capability unit IIe-5.—Deep, moderately permeable, well-drained, gently sloping soils with a fine sandy loam surface layer.
- Subclass IIs. Soils that have moderate limitations of moisture capacity or shallow rooting zone.
  - Capability unit IIs-2.—Nearly level, well-drained soils with a fine-textured subsoil near the surface.
  - Capability unit IIs-6.—Nearly level to gently sloping, well-drained soils that have a very sandy, droughty surface layer.
- Subclass IIw. Soils that have moderate limitations because of excess water.
  - Capability unit IIw-1.—Gently sloping, moderately well drained, slowly permeable soils.
  - Capability unit IIw-11.—Nearly level, somewhat poorly drained, slowly permeable soils with a loam surface layer.
  - Capability unit IIw-12.—Nearly level, somewhat poorly drained, slowly permeable soils with a fine sandy loam surface layer.
  - Capability unit IIw-13.—Nearly level, moderately well or somewhat poorly drained, moderately permeable soils with a loam surface layer.
  - Capability unit IIw-14.—Nearly level to gently sloping, moderately well or somewhat poorly drained, moderately permeable soils with a fine sandy loam surface layer.
  - Capability unit IIw-15.—Nearly level to gently sloping, moderately well drained soils with a loamy fine sand surface layer.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
- Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.
  - Capability unit IIIe-1.—Moderately sloping, slowly permeable soils with a loam surface layer.
  - Capability unit IIIe-2.—Moderately sloping, slowly permeable soils that mainly have a fine sandy loam or loamy sand surface layer.
  - Capability unit IIIe-5.—Moderately sloping, well-drained, moderately permeable soils that have a fine sandy loam surface layer.
  - Capability unit IIIe-6.—Moderately sloping, well-drained soils that have a loamy sand surface layer.
- Subclass IIIs. Soils that have severe limitations of moisture capacity.
  - Capability unit IIIs-6.—Nearly level or gently sloping, moderately permeable soils that have a thick sandy surface layer.
- Subclass IIIw. Soils that are severely limited by excess water.
  - Capability unit IIIw-11.—Nearly level, slowly permeable, somewhat poorly drained soils with a loam surface layer.
  - Capability unit IIIw-12.—Nearly level,

slowly permeable, somewhat poorly drained soils with a loamy sand or fine sandy loam surface layer.

Capability unit IIIw-15.—Nearly level to gently sloping, moderately permeable soils with a loamy sand or sand surface layer.

Capability unit IIIw-16.—Nearly level, moderately well and somewhat poorly drained soils with a sand or fine sand surface layer.

Capability unit IIIw-20.—Nearly level, moderately permeable to slowly permeable, poorly drained soils with a fine sandy loam to loam surface layer.

Capability unit IIIw-21.—Nearly level, poorly drained, moderately permeable to slowly permeable soils.

Capability unit IIIw-24.—Nearly level, very poorly drained, moderately permeable soil.

Capability unit IIIw-25.—Nearly level, very poorly drained, moderately permeable and slowly permeable soils.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.

Capability unit IVe-5.—Deep, moderately permeable, moderately steep soils that are severely eroded and moderately sloping.

Subclass IVs. Soils that have very severe limitations because of low moisture capacity, low fertility, or both.

Capability unit IVs-6.—Moderately sloping soils with a very thick, sandy surface layer.

Capability unit IVs-7.—Nearly level to moderately sloping, deep, very sandy soils or soils that have a very thick, very sandy surface layer.

Capability unit IVs-8.—Nearly level to moderately sloping, moderately permeable soils with a bleached surface layer.

Subclass IVw. Soils that have severe limitations of low moisture capacity and low fertility, or a high water table in winter.

Capability unit IVw-17.—Nearly level to gently sloping, very sandy, infertile soils that are moderately well drained to somewhat poorly drained.

Capability unit IVw-21.—Nearly level soils that have a high water table and an ironstone layer in the subsoil.

Class V. Soils not likely to erode, that have other limitations impractical to remove without major reclamation. These limitations make regular cultivation impractical and limit the use of the soils to woodland or wildlife habitats. (Cranberries and blueberries grown extensively on these soils are considered special crops.)

Subclass Vw. Soils that are impractical to use for regular crops, because of excess water and infertility.

Capability unit Vw-22.—Nearly level, poorly drained, infertile sands.

Capability unit Vw-26.—Nearly level, very poorly drained, infertile sands.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and limit their use mainly to pasture, woodland, or food and cover for wildlife.

Subclass VIe. Soils severely limited, chiefly by risk of erosion, if protective cover is not maintained.

Capability unit VIe-1.—Moderately steep, slowly permeable soils.

Capability unit VIe-5.—Steep, severely eroded, moderately permeable soils.

Subclass VIw. Soils severely limited by excess water, that are generally unsuitable for cultivation.

Capability unit VIw-28.—Nearly level soils that are frequently flooded and have a high water table.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation, and that restrict their use mainly to range, woodland, or wildlife habitats.

Subclass VIIe. Soils severely limited, chiefly by risk of erosion, if protective cover is not maintained.

Capability unit VIIe-1.—Steep, slowly permeable soils.

Subclass VIIs. Soils severely limited by moisture capacity, fertility, or both.

Capability unit VIIs-7.—Nearly level to moderately sloping, very sandy, droughty soils.

Capability unit VIIs-8.—Nearly level to moderately steep, very sandy, very infertile, droughty soils.

Subclass VIIw. Soils very limited by excess water.

Capability unit VIIw-30.—Highly organic soils that are frequently flooded and have a high water table.

Class VIII. Soils that have limitations that preclude their use, without major reclamation, for commercial growth of plants. These limitations restrict the use of soils to recreational and scenic areas, wildlife habitats, and watersheds.

Subclass VIIIw. Soils very limited by excess water.

Capability unit VIIIw-29.—Soils ponded for long periods with fresh water or flooded daily by tidal water.

Use of the Soils as Commercial Woodland

This section contains information about the suitability of the soils of the county as woodland. The soils have been placed into groups that reflect their productive capacity, important soil hazards, and management limitations.

Except for the tidal marsh, all of Burlington County was originally in forest vegetation. The inner Coastal Plain was mostly hardwoods and a scattering

of Virginia pine, redcedar, and Atlantic white-cedar. Clearing for crops reduced the woodland in the inner Coastal Plain to less than 10 percent of the area and confined it mostly to the steeper slopes, to the poorly drained soils, and to soils subject to frequent flooding. According to a survey concluded in 1967, commercial woodland totaled over 300,000 acres.

The well drained and moderately well drained soils support upland oak forest composed of northern red oak, scarlet oak, chestnut oak, black oak, white oak, yellow-poplar, hickory, beech, white ash, black birch, and a number of less valuable trees. The black walnut and black locust planted around the farmsteads are not native to the area.

Poorly drained soils support the lowland oak forests, which consist of pin oak, willow oak, swamp white oak, holly, sweetgum, and red maple. The gum trees seed readily and occupy a site for 50 to 100 years until the oaks become established. Bottom lands that are subject to stream overflow contain most of the trees common to the upland and lowland oak forests. Also mixed in the stand are elm, boxelder, sycamore, and river birch. Timber has been harvested a number of times since the county was settled.

Trees on the sandy soils of the outer Coastal Plain are mostly pitch, shortleaf, and Virginia pines. Where the wildfire damage has not been severe, some areas contain upland oaks. Originally the pines were large enough to produce lumber, but almost all of them are now cut for pulpwood. This is because the trees frequently have been harvested or burned by wildfires. Where fires have been severe on the outer Coastal Plain, the trees are scrubby and the stands consist of pitch pine, scrub oak, blackjack oak, post oak, and a few black oaks.

In two areas, called the plains and consisting of about 14,000 acres, the forest vegetation is dwarfed regardless of age. In most places trees range from 3 to 5 feet in height, though in some places they grow to 5 to 10 feet. This stunted growth has been attributed to frequent wildfires (*2*, *5*, *9*), but other causes cited are high wind velocity, soils of poor quality, hardpans, and toxic quantities of soluble aluminum (*6*).

The lowlands in the outer Coastal Plain support only pitch pine and Atlantic white-cedar. The white-cedar grows best on Muck, which is highly organic soil and almost constantly saturated.

Woodland suitability groups

The soils of the county have been placed in woodland suitability groups to assist owners in planning the use of their soils for wood crops. Each group is made up of soils that are suited to the same kinds of trees, that need about the same management where the vegetation on them is similar, and that have the same potential production.

Each woodland group is identified by a three-part symbol, such as 1o1, 2w1, or 3w3. The potential productivity of the soils in the group is indicated by the first number in the symbol: 1, very high; 2, high; 3, moderately high; 4, moderate; and 5, low. These ratings are based on field determination of average site index. Site index of a given soil is the height, in feet, that the taller trees of a given species reach in a natural, essentially unmanaged stand in a stated number of years. Site index can be converted into approximate expected growth and yield per acre in cords and board feet. For Burlington County, conversions of average site index into volumetric growth and yield are based on research as follows: Upland oaks (*17*); yellow-poplar (*4*); sweetgum (*23*); and shortleaf pine (*18*).

The second part of the symbol identifying a woodland group is a small letter. In this county *w*, *s*, *r*, and *o* are used. Except for the *o*, the small letter indicates an important soil property that imposes a hazard or limitation in managing the soils of the group for trees. The letter *o* shows that the soils have few limitations that restrict their use for trees. The letter *w* means excessive wetness, either seasonal or all year. The soils have restricted drainage, have high water tables, or are subject to flooding. The letter *s* stands for sandy soils that have little or no difference in texture between surface layer and subsoil (B horizon). These soils are moderately to severely restricted for woodland use. They have low available water capacity and are low in available plant nutrients. The letter *r* shows that the main limitation is steep slopes and that there is hazard of erosion and possibly limitations to use of equipment. In this county *r* is used if slopes are greater than 15 percent.

The last part of the symbol, another number, differentiates woodland suitability groups that have identical first and second parts in their identifying symbol. Soils in woodland group 3w1, for example, require somewhat different management than soils in group 3w2.

In table 4 each woodland suitability group in the county is rated for various management hazards or limitations. These ratings are *slight*, *moderate*, or *severe*, and they are described in the following paragraphs.

Equipment limitations depend on soil characteristics that restrict or prohibit the use of harvesting equipment, either seasonally or continually. *Slight* means no restrictions in the kind of equipment or time of year it is used; *moderate* means that use of equipment is restricted for 3 months of the year or less; severe means that special equipment is needed and that its use is severely restricted for more than 3 months of the year.

Seedling mortality refers to mortality of naturally occurring or planted tree seedlings, as influenced by kinds of soil or topographic conditions when plant competition is assumed not to be a factor. *Slight* means a loss of 0 to 25 percent; *moderate* means a loss of 25 to 50 percent; and *severe* means a loss of more than 50 percent of the seedlings. It is assumed that seed supplies are adequate.

Plant competition is the degree to which undesirable plants invade openings in the tree canopy. Considered in the ratings are available water capacity fertility, drainage, and degree of erosion. Conifers and hardwoods are rated separately in table 4. *Slight* means that plant competition does not prevent adequate natural regeneration and early growth or interfere with seedling development; *moderate* means that competition delays natural or artificial establishment and

TABLE 4.—*Woodland suitability groups, hazards to their management suitable species, and prod*

Woodland suitability groups, soil series, and map symbols	Equipment limitations	Seedling mortality	Plant competition		Windthrow hazard	Suitable species		Productiv
			Conifers	Hardwoods		To favor in existing stands	For planting	Commercial trees
Group 1o1 Collington: CnA, CnB, CnC, CoA, CoB. **Freehold:** FfA, FfB, FfC, FfD, FgB, FoC3, FoD3.	Slight	Slight	Severe	Moderate	Slight	Yellow-poplar, upland oaks, and Virginia pine.	Yellow-poplar, red oak, black walnut, black locust (for posts), white pine and Austrian pine (for Christmas trees).	Yellow-poplar.[1] Upland oaks.
Group 1r1 **Freehold:** FfE.	Moderate	Slight	Severe	Moderate	Slight	Yellow-poplar, upland oaks, and Virginia pine.	Yellow-poplar, and white pine.	Yellow-poplar.[1] Upland oaks.
Group 1w1 **Alluvial land, loamy:** Ao.	Severe	Severe	Severe	Severe	Moderate	Yellow-poplar, sweetgum, oak, and ash.	None[2]	Yellow-poplar.[1] **Sweetgum** Upland oaks. Lowland oaks.
Group 2o1 **Freehold:** FhB, FhC. **Marlton:** MhA, MhB, MrC. **Sassafras:** SfB, SgA, SgB, SgC, ShA, ShB. **Westphalia:** WaA, WaB, WdA, WdB.	Slight	Slight	Severe	Moderate	Slight	Yellow-poplar, upland oaks, and Virginia pine.	Yellow-poplar, black walnut, white pine, and Austrian pine (for Christmas trees); black locust (for posts).	Yellow-poplar.[1] Upland oaks. Virginia pine.
Group 2r1 **Keyport:** KlE.	Moderate	Slight	Moderate	Slight	Slight	Upland oaks.	Red oak and white pine.	Upland oaks.

Group 2w1 Adelphia: AaA, AaB, AcA, AcB, AhA, Ak, AnA, AnB. Donlonton: DeB, DlA. Holmdel: HdA, HdB, HlB, HmA, HmB. Keyport: KeB, KfB, KlA, KlB, KlC, KlD. Kresson: KwA, KxA, KyA. Nixonton: NbA, NbB, NcA, NcB. Woodstown: WkA, WlA, WmA, WmB, WnA, WnB.	Moderate	Slight	Severe	Moderate	Slight for Keyport, Kresson, and Donlonton soils; moderate for all others.	Yellow-poplar, upland oaks, and sweetgum.	Yellow-poplar, sweetgum, red oak, and black walnut.	Yellow-poplar. Upland oaks. Sweetgum.[1]
Group 3o1 Downer: DoA, DoB, DoC, DpB, DrA, DsB.	Slight	Slight to moderate.	Moderate	Slight	Slight	Upland oaks and Virginia pine.	White pine	Upland oaks. Virginia pine.
Group 3s1 Evesboro: EvB, EvC, EwB, EyB. Galestown: GaA, GcB. Klej: KmA, KnA, KoA. Pemberton: PbA, PcA. Sandy land, ironstone: Se. Tinton: TsB, TsC, TtB.	Moderate	Slight to moderate.	Moderate	Slight	Slight	Shortleaf pine and pitch pine.	White pine	Upland oaks. Virginia pine. Shortleaf pine.
Group 3w1 Alluvial land, sandy: Ap. Atsion: At, Au, Av, Aw. Berryland: Bp, Bt, Bu.	Severe	Severe	Severe	Severe	Severe for Ap; moderate for other mapping units.	Pitch pine; Atlantic white-cedar on Berryland soils.	Pitch pine	Pitch pine
Group 3w2 Colemantown: Cm. Fallsington: Fa, Fc. Keansburg: Ka. Pasquotank: Pa. Pocomoke: Pv. Shrewsbury: Sn, So, Sp, Sv, Sx.	Severe	Severe	Severe	Severe	Moderate for Cm; severe for other mapping units.	Lowland oaks and sweetgum.	Sweetgum and pin oak.	Sweetgum.[1] Lowland oaks.
Group 3w3 Muck, shallow: Mu.	Severe	Severe	Severe	Severe	Severe	Atlantic white-cedar.	None[3]	Atlantic white cedar.

TABLE 4.—*Woodland suitability groups, hazards to their management, suitable species, and productivity*—Con.

Woodland suitability groups, soil series, and map symbols	Equipment limitations	Seedling mortality	Plant competition		Windthrow hazard	Suitable species		Productiv
			Conifers	Hardwoods		To favor in existing stands	For planting	Commercial trees
Group 4s1 Lakehurst: LaA, LlA, LmA, LnA, LoA, LrA, LsA. Woodmansie: WeB, WeC, WgB, WhB.	Moderate for Lakehurst soils; slight for Woodmansie soils.	Moderate	Slight	Slight	Slight	Pitch pine and shortleaf pine.	Pitch pine and shortleaf pine.	Pitch pine Shortleaf pine. Virginia pine.
Group 5s1 Lakewood: LtB, LtC, LtD, LuB, LvB, LwB, LyA.	Slight	Moderate	Slight	Slight	Slight	Shortleaf pine, Virginia pine, and pitch pine.	Pitch pine and shortleaf pine.	Pitch pine Shortleaf pine. Virginia pine.

[1] Species on which estimates of site index are based.
[2] Planting trees is not feasible.

growth rate, but does not prevent the development of fully stocked normal stands; *severe* means that competition prevents adequate natural or artificial regeneration unless the site is prepared properly and maintenance practices, such as burning, spraying, disking, or girdling, are used.

Windthrow hazard depends on the soil characteristics that enable trees to resist being blown down by wind. *Slight* means that most trees withstand the wind; *moderate* means that some trees are expected to blow down during excessive wetness and high wind; *severe* means that many trees are expected to blow down during periods when the soil is wet and winds are moderate or high.

Table 4 lists suitable species to favor in existing stands and suitable species for planting. The estimated site index in table 4 is the height, in feet, that the tallest trees reach at 50 years of age on the soils of each group.

Because demands for woodland products and values change from time to time, current information on what trees to plant or how to manage woodland should be obtained from the district forester for the New Jersey Department of Conservation and Economical Development. For general information concerning forestry, consult the extension forester of the Agricultural Extension Service.

Use of Soils for Wildlife

The wildlife population of any area depends upon the availability of food, cover, and water in a suitable combination. Burlington County has more extensive woodland tracts and a larger deerherd than any other of the Coastal Plain counties. Because the soils are infertile, however, the deer in this county have a smaller size and lower rate of reproduction than those in the Piedmont province (*11*). Plants that furnish food for wildlife are not naturally abundant in many areas of the county. Suitable habitats are created, improved, and maintained by establishing desirable vegetation (fig. 24).

Figure 24.—**Large amounts of nutritious deer food are produced in limed and fertilized woodland clearings that are established and maintained by the New Jersey Fish and Game Commission.**

Suitability ratings of soils for wildlife habitats

In the following paragraphs, the various elements of wildlife habitat are described and the soils in the county are rated for their suitability for establishment, improvement, or maintenance of wildlife habitat, and for three classes of wildlife. The suitability ratings are given in table 5. These ratings were based on soil characteristics, not on climate, present land use, or the distribution of wildlife and human populations. The suitability of individual sites must be determined by onsite inspection. Since Urban land units and complexes and Made land units do not provide any suitability habitats for wildlife, they are not included in table 5.

In table 5 the soils are rated 1, well suited; 2, suited; 3, poorly suited; and 4, unsuited. *Well suited* means that habitats generally are easily created, improved, or maintained and that the soils have few or no limitations that affect management for wildlife. *Suited* means that habitats can be created, improved, or maintained in most places, that the soils have moderate limitations that affect management, and that moderately intensive management is required. *Poorly suited* indicates that, although habitats can be created, improved, or maintained in most places, the soils have severe limitations, and management for wildlife is difficult, expensive, and not always successful. *Unsuited* indicates that it is impractical or impossible to create, improve, or maintain satisfactory habitats.

The elements of habitat for which the suitability of the soils are rated in table 5 are described as follows:

Grain and seed crops are seed-producing annuals, such as corn, sorghum, wheat, oats, barley, millet, buckwheat, soybeans, and sunflower.

Grasses and legumes are perennial grasses and herbaceous legumes that have been planted and that furnish food and cover for wildlife. The grasses include fescue, brome, bluegrass, timothy, redtop, orchardgrass, and reed canarygrass. The legumes include alfalfa, clover, crown vetch, and trefoils.

Wild herbaceous upland plants are native or introduced perennial grasses and forbs, or weeds, that provide food and cover for upland wildlife. These plants include bluestem, indiangrass, wild ryegrass, oatgrass, pokeweed, strawberry, lespedeza, burnet, beggarweed, wildbean, nightshade, goldenrod, and dandelion.

Hardwood woody plants are nonconiferous trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, twigs (browse), or foliage used extensively as food by wildlife. These plants commonly are naturally established, but they have been planted in some places. They include oak, beech, hickories, yellow-poplar, maple, birch, sassafras, blackgum, hawthorn, dogwood, viburnum, bayberry, grape, honeysuckle, blueberry, greenbrier and other briers, autumn-olive, and multiflora rose.

TABLE 5.—*Suitability of the soils for wildlife habitats and kinds of wildlife*

Soil series and map symbols	Elements of wildlife habitat							
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Excavated ponds
Adelphia:								
AaA, AaB, AcA, AcB, AhA, Ak, AnA, AnB	2	1	1	1	3	3	3	[1] 3–4
Alluvial land, loamy:								
Ao	3	2	2	1	3	1	1	[2] 3
Alluvial land, sandy:								
Ap	4	3	3	1	3	3	2	[2] 4
Atsion:								
At, Au, Av, Aw	4	3	3	[3] 3	2	3	1	1
Berryland:								
Bp, Bt, Bu	4	3	3	[3] 3	1	3	1	1
Colemantown:								
Cm	3	2	2	1	3	3	1	1
Collington:								
CnA, CoA	1	1	1	1	3	4	4	4
CnB, CnC, CoB	2	1	1	1	3	4	4	4
Donlonton:								
DeB, DlA	2	1	1	1	3	3	2	[1] 2
Downer:								
DoA, DoB, DoC, DpB, DrA, DsB	3	2	2	2	2	4	4	4
Evesboro:								
EvB, EvC, EwB, EyB	3	3	3	3	1	4	4	4
Fallsington:								
Fa, Fc	3	2	2	1	2	1	1	[1] 1
Freehold:								
FfA	1	1	1	1	3	4	4	4
FfB, FfC, FgB	2	1	1	1	3	4	4	4
FhB, FhC	3	2	2	1	3	4	4	4
FfD, FoC3	3	2	1	1	2	4	4	4
FfE, FoD3	4	3	1	1	2	4	4	4
Galestown:								
GaA, GcB	3	3	3	2	2	4	4	4
Holmdel:								
HdA, HdB, HmA, HmB	2	1	1	1	3	3	3	3
HlB	3	2	1	1	3	3	3	3
Keansburg:								
Ka	4	2	3	1	3	1	1	1
Keyport:								
KeB	3	1	1	1	3	3	3	3
KfB, KlA, KlB, KlC	2	1	1	1	3	3	3–4	[1] 3
KlD	3	2	1	1	3	4	4	4
KlE	4	3	1	1	3	4	4	4
Klej:								
KmA, KnA, KoA	3	3	3	2	3	3	3	3
Kresson:								
KwA	3	2	2	1	3	3	2	2
KxA, KyA	2	1	1	1	3	2	2	2

Lakehurst:								
LaA, LlA, LmA, LnA, LoA, LrA, LsA	4	4	4	3	1	3	3	3
Lakewood:								
LtB, LtC, LtD, LuB, LvB, LwB, LyA	4	4	4	3	1	4	4	4
Marlton:								
MhA; MhB, MrC	2	1	1	1	3	4	4	4
Marsh, fresh water:								
Ms	4	4	4	4	4	1	1	1
Marsh, tidal:								
Mt	4	4	4	4	4	1	3	4
Muck:								
Mu	4	4	4	3	3	2	1	1
Nixonton:								
NbA, NbB	2	1	2	1	3	3	3	3
NcA, NcB	3	1	1	1	3	3	3	3
Pasquotank:								
Pa	3	2	2	1	3	1	1	1
Pemberton:								
PbA, PcA	3	3	3	2	1	3	3	3
Pits, sand and gravel:								
Pt	4	3	4	4	1	4	3–4	3–4
Pits, clay and marl:								
Pu	4	3	2	2	3	3	2	[1] 2
Pocomoke:								
Pv	4	3	3	1	1	1	1	1
Sandy land, ironstone:								
Se	4	3	3	3	1	4	4	4
Sassafras:								
SgA, ShA	1	1	1	1	3	4	4	4
SgB, SgC, ShB	2	1	1	1	3	4	4	4
SfB	3	2	2	2	2	4	4	4
Shrewsbury:								
Sn, So, Sp, Sv, Sx	3	2	2	1	3	1	1	1
Tinton:								
TsB, TsC, TtB	3	3	3	2	1	4	4	4
Westphalia:								
WaA, WaB, WdB	3	1	1	1	3	4	4	4
WdA	1	1	1	1	3	4	4	4
Woodmansie:								
WeB, WeC, WgB, WhB	4	3	3	2	2	4	4	4
Woodstown:								
WkA, WlA	3	2	2	1	3	3	3	3
WmA, WmB, WnA, WnB	2	1	1	1	3	3	3	3

[1] Underlying clays are so strongly acid in places that fish management is impractical in the following units: AcA, AcB, DeB, Dl

[2] Limitation based on overflow hazard.

[3] Limitation based on the few adapted hardwood plants.

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Coniferous woody plants are cone-bearing trees and shrubs that are used by wildlife primarily as cover, though they also provide browse and seeds. Generally, these plants are established naturally in areas where the cover of weeds and sod is thin. Well-suited soils are those on which plants grow and close the canopy slowly. Where branches are maintained close to the ground, food and cover are readily available to rabbits, pheasants, and other small animals. These lower branches die if the trees quickly form a dense canopy that shuts out the light. On soils rated poorly suited, hardwoods invade and commonly overtop the conifers. Coniferous plants include pine, white-cedar, redcedar, hemlock, juniper, and yew.

Wetland food and cover plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. These plants furnish food or cover mostly for wetland wildlife. They include smartweed, wild millet, spikerush and other sedges, burreed, wildrice, rice cutgrass, cattails, and rushes, but not submerged or floating aquatic plants.

Shallow water developments are impoundments or excavations for controlling water that generally are not more than 6 feet deep. Control structures include low dikes and levees, shallow dugouts, level ditches, and devices for controlling the water level in marshy drainageways or channels.

Excavated ponds are dugouts or combinations of dugouts and low dike impoundments. To be suitable for fish, they require an ample supply of water. They include ponds built on nearly level soils that have a surface area of at least one-fourth of an acre, an average depth of 6 feet in at least one-fourth of their area, and a dependable source of unpolluted water. Areas subject to frequent flooding are rated not suitable.

As shown in table 5, there are three main classes of wildlife in the county. They are defined as follows:

Openland wildlife: Birds and mammals that normally make their homes in areas of cropland, pasture, meadow, and lawns and in areas overgrown with grasses, herbs, and shrubs. Examples are pheasants, meadowlarks, field sparrows, doves, cottontail rabbits, red foxes, and woodchucks.

Woodland wildlife: Birds and mammals that obtain food and cover in stands of hardwoods, coniferous trees, and shrubs. They include ruffed grouse, woodcocks, thrushes, vireos, scarlet tanagers, gray and red squirrels, gray foxes, white-tailed deer, and raccoons.

Wetland wildlife: Birds and mammals that normally make their home around ponds and in marshes, swamps, and other wet areas. Familiar examples are ducks, geese, rails, herons, shore birds, minks, muskrats, and beaver.

The ratings that in table 5 show the suitability of the soils for the three classes of wildlife are based on the ratings for habitat elements in the first part of the table. For openland wildlife the ratings are based on ratings for grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood plants, and coniferous plants. The ratings for woodland wildlife are based on ratings for all the elements except grain and seed crops. For wetland wildlife the ratings are based on ratings shown for wetland food and cover plants, shallow water developments, and excavated ponds.

Engineering Applications[3]

This section contains information useful to engineers who need to know about the kinds and behavior of soils and soil materials that affect the design, construction, and maintenance of engineering works in Burlington County.

The engineering test data for specified soils in table 6 were used to prepare the estimated properties for all soils of Burlington County as shown in table 7. Then the engineering properties were interpreted as shown in table 8. In addition, interpretations of interest to engineers and others concerned with community development are given in the section "Soils in Community Development." Terms used by soil scientists that may have special meaning in soil science are in the Glossary at the back of this survey.

Some soil properties are important to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage disposal systems. Among these are permeability to water, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, and plasticity. The depth to the water table and the topography are also important.

[3] RICHARD H. MARSTON, State conservation engineer, Soil Conservation Service assisted in preparing this section.

The information in this soil survey can be used by engineers to:

1. Make soil and land use studies that will aid in selecting and developing industrial, commercial, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils in the planning of drainage ponds, irrigation, and the control of sediment, pollution, and erosion.
3. Make preliminary evaluation of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
4. Locate probable sources of sand and gravel.
5. Correlate performance of engineering structures with soils and thus develop information that will be useful in designing and maintaining the structures.
6. Determine the suitability of soil mapping units for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps and reports for the purpose of making additional maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

With the use of the soil map for identification, the engineering properties reported here can be used for many purposes. It should be emphasized, however, that these interpretations are not a substitute for the sampling and testing needed at the site chosen for specific engineering work where heavy loads are involved or where the excavations are deeper than the depth reported. Also, engineers should not apply specific values to the estimates of bearing capacity given in this survey. Nevertheless, the soil map and interpretations are useful for planning more detailed investigations and for suggesting the kinds of problems that may be expected.

Engineering classification of soils

The two systems most commonly used in classifying soils for engineering are the AASHO system (*1*) adopted by the American Association of State Highway Officials, and the Unified system (*27*).

The AASHO system is used to classify soils according to those properties that affect use in highway construction. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation), and clay soils that have low strength when wet. The best soils for subgrade are classified as A–1, the next best A–2, and so on to class A–7, the poorest soils for subgrade. Where laboratory data are available to justify a more specific classification, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–7, A–7–5, and A–7–6. If soil material is near a classification boundary it is given a symbol showing both classes; for example, A–2 or A–4. Within each group, the relative engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. In table 6 the group index number is shown in parentheses for each tested soil. The estimated classification for all soils mapped in the survey area is given in table 7.

In the Unified system, soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are 8 classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; 6 classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and 1 class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes, for example, SM–SC. These classifications also are listed in tables 6 and 8.

Engineering test data

All engineering test data in this survey are based on sampling and testing by the College of Engineering, Rutgers University (*10, 16*). The tested soils are classified according to the Unified and AASHO systems. Some of the soil names used in the original study were changed so that they would agree with the current soil survey classification.

Grain-size distribution is reported in table 6 as percentage of material, by weight, passing the 3/4-inch sieve, and the No. 4, 10, 40, and 200 sieves. Hydrometer analysis is reported in percent of total sample. This analysis is not accurate for the content of clay as defined in this survey (less than 0.002 millimeter in diameter) and should not be used to determine the USDA textural classes.

Liquid limit and plastic limit are determined by testing material less than 2.0 millimeters in diameter. The liquid limit is the moisture content at which the soil material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The plasticity index is the difference between the liquid limit and the plastic limit.

In the moisture-density test, soil material was compacted in a mold several times with a constant compaction effort, each time at a successively higher moisture content. The density, or unit weight, of the soil material increases until the optimum moisture content is reached. After that the density decreases with increase in moisture content. The highest density obtained in the compaction test is called maximum density. Data showing moisture density are important in earthwork, for as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

Estimated engineering properties of the soils

Table 7 provides estimates of soil properties important to engineers. The estimates are based on field classification and descriptions, on the results of tests on soils in this county and on comparable soils in adja-

TABLE 6.—*Engine*

[Tests performed by the College of Engineering, Rutgers University, in accordance with

Soil and symbol	Site number	Sampling site: Latitude	Sampling site: Longitude	Depth	Test results — Sieve analysis — Cumulative percentage passing sieve—: ¾ inch	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)
				Inches			
Adelphia fine sandy loam (AaA) (Thinner solum than in modal)	130	39°59′54″	74°42′09″	0–10			100
				10–20			100
				20–44	100	99	98
Adelphia fine sandy loam (AaA) (Modal)	155	40°01′46″	74°42′46″	0–8		100	99
				8–18			100
				18–32			100
				32–48			100
Adelphia fine sandy loam, clayey substratum (AcA).	156	40°01′38″	74°44′38″	0–8		100	99
				8–28			100
				28–48			100
Adelphia loam (AhA)	140	40°03′33″	74°45′35″	0–11			100
				11–20			100
				20–28			100
				28–47			100
				47–64			100
Alluvial land, loamy (Ao)	104	39°56′00″	74°56′21″	0–8	99	98	97
				8–27	100	99	99
				27–50			100
				50–60			100
Alluvial land, loamy (Ao)	132	40°01′43″	74°41′01″	0–6			100
				6–22			100
				22–72			100
Atsion sand (At)	94	39°37′15″	74°29′21″	0–8		100	99
				8–20			100
				20–28			100
				28–48			100
				48–60			100
Atsion fine sand (Av)	86	39°45′10″	74°42′05″	0–13			100
				13–31			100
				31–48	100	96	92
Colemantown loam (Cm)	145	40°00′57″	74°46′37″	0–9			100
				9–26			
				26–43			100
				43–54	100	96	95
Collington fine sandy loam (CnA)	99	40°05′32″	74°40′50″	0–16	100	99	99
				16–33		100	99
				33–41	98	95	95
				41–56			100
Donlonton loam (DlA)	137	40°06′00″	74°42′00″	0–8		100	99
				8–26			100
				26–51			100
				51–68			100
Downer loamy sand (DoA)	2	39°58′55″	74°36′10″	0–8			100
				8–24		100	99
				24–44	100	97	96
				44–84	100	92	86
Downer loamy sand, gravelly substratum (DpB)	30	39°41′15″	74°34′10″	0–2		100	97
				2–20	100	98	96
				20–61	97	72	66
Evesboro sand (EvB)	25	39°54′19″	74°39′00″	0–6		100	99
				6–30	99	98	97
				30–44	99	98	95
				44–64	100	99	93
				64–84			100

ering test data

standard procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Test results—Con.								Classification	
Sieve analysis—Con. Cumulative percentage passing sieve—Con.		Hydrometer analysis		Liquid limit [1]	Plasticity index [2]	Maximum density [3]	Optimum moisture content	AASHO	Unified [4]
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05–0.005 mm.	<0.005 mm.						
		Percent	*Percent*	*Percent*		*Lb./cu. ft.*	*Percent*		
90	38			27	5			A-4(1)	SM-SC
88	43			27	8			A-4(2)	SM-SC
83	15			NL	NP			A-2-4(0)	SM
92	35			31	9			A-2-4(0)	SM-SC
95	44	12	18	27	10			A-4(2)	SC
96	51	16	25	37	12			A-6(4)	ML-CL
96	24			NL	NP			A-2-4(0)	SM
73	36			41	12			A-7-6(1)	SM
95	57	26	22	35	12			A-6(5)	ML-CL
98	72	27	23	41	14			A-7-6(9)	ML-CL
93	53			24	4			A-4(4)	ML-CL
93	60			22	4			A-4(5)	ML-CL
95	72	44	25	27	8			A-4(7)	CL
94	66	37	24	24	6			A-4(6)	ML-CL
92	32			21	5			A-2-4(0)	SM-SC
91	11			NL	NP			A-2-4(0)	SP-SM
88	14			NL	NP			A-2-4(0)	SM
95	31	10	23	33	12	106	18	A-2-6(0)	SM-SC
95	15			NL	NP			A-2-4(0)	SM
54	27			52	15			A-2-7(1)	SM
53	37			77	13	60	55	A-7-5(2)	SM
97	85			42	5	90	25	A-5(8)	ML
74	0			NL	NP			A-3(0)	SP
76	1			NL	NP			A-3(0)	SP
80	0			NL	NP			A-3(0)	SP
81	6			NL	NP			A-3(0)	SP-SM
90	2			NL	NP			A-3(0)	SP
92	9			NL	NP			A-3(0)	SP-SM
88	2			NL	NP	103	14	A-3(0)	SP
55	1			NL	NP	109	13	A-3(0)	SP
99	93			46	12			A-7-5(10)	ML
100	89	65	13	49	19			A-7-6(13)	ML-CL
98	87	63	17	52	23			A-7-6(16)	MH-CH
88	42			25	5			A-4(4)	SM-SC
91	40			22	2			A-4(1)	SM
95	54	28	22	27	10	115	15	A-4(4)	CL
89	26	10	14	23	6			A-2-4(0)	SM-SC
92	20			NL	NP	115	14	A-2-4(0)	SM
91	69			37	11			A-6(7)	ML-CL
95	82	46	34	48	17			A-7-5(12)	ML
99	85	46	37	34	14			A-6(10)	CL
97	45			20	1			A-4(2)	SM
79	21			NL	NP			A-2-4(0)	SM
83	27			NL	NP	121	9	A-2-4(0)	SM
66	12			NL	NP			A-2-4(0)	SP-SM
48	1			NL	NP	119	11	A-1-b(0)	SP
65	9			NL	NP			A-3(0)	SP-SM
80	18			NL	NP	118	10	A-2-4(0)	SM
47	10			NL	NP	121	10	A-1-b(0)	SP-SM
62	5			NL	NP			A-3(0)	SP-SM
68	5			NL	NP			A-3(0)	SP-SM
52	1			NL	NP			A-3(0)	SP
58	4			NL	NP			A-3(0)	SP
96	1			NL	NP			A-3(0)	SP

TABLE 6.—*Engineering*

Soil and symbol	Site number	Sampling site: Latitude	Sampling site: Longitude	Depth	Test results: Sieve analysis: Cumulative percentage passing sieve— ¾ inch	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)
				Inches			
Evesboro sand (EvB)	28	39°37′05″	74°34′35″	0–6	100	99	99
				6–24	100	96	95
				24–40	99	93	90
				40–72	100	94	92
Evesboro sand (EvB)	80	39°46′58″	74°52′45″	0–16	----	----	100
				16–28	99	96	94
				28–39	99	92	85
				39–84	100	94	84
Evesboro fine sand (EyB)	84	39°50′12″	74°45′05″	0–6	----	----	100
				6–19	----	----	100
				19–44	----	----	100
Freehold fine sandy loam (FfA) (Coarser textured subsoil than in modal)	101	40°00′20″	74°46′11″	0–9	----	----	100
				9–15	----	----	100
				15–36	----	----	100
				36–52	----	----	100
Freehold fine sandy loam (FfA) (Modal)	135	40°05′34″	74°33′43″	0–12	----	----	100
				12–22	----	----	100
				22–30	----	----	100
Freehold fine sandy loam, clayey substratum (FgB).	44	40°08′42″	74°37′51″	0–13	99	97	96
				13–20	100	97	96
				20–26	97	88	87
				26–44	98	98	98
				44–59	----	----	100
Holmdel loamy sand (HlB) (Modal)	55	39°59′15″	74°41′48″	0–10	----	----	100
				10–20	----	----	100
				20–34	----	----	100
				34–72	----	100	99
Holmdel loamy sand (HlB)	108	39°53′02″	74°52′50″	0–16	----	----	100
				16–23	----	----	100
				23–40	----	----	100
				40–56	----	----	100
Holmdel loamy sand (HlB) (Solum thinner than in modal)	115	40°00′01″	74°40′17″	0–9	----	----	100
				9–16	----	----	100
				16–60	----	----	100
Keansburg fine sandy loam (Ka) (Modal)	119	39°57′55″	74°42′40″	0–12	----	----	100
				12–20	----	----	100
				20–28	----	----	100
				28–46	----	----	100
Keansburg fine sandy loam (Ka)	129	39°55′30″	74°49′30″	0–14	98	92	89
				14–27	99	95	94
				27–36	99	94	92
Keyport fine sandy loam (KfB)	136	40°06′15″	74°43′57″	0–7	91	87	84
				7–24	98	95	94
				24–48	----	----	100
Keyport loam (KlA)	66	40°03′41″	74°47′31″	0–10	----	----	100
				10–27	----	----	100
				27–42	----	----	100
Klej fine sand (KoA)	6	39°35′03″	74°24′04″	0–2	----	----	100
				2–6	----	----	100
				6–38	----	----	100
				38–48	----	----	100
				48–64	----	----	100
Klej fine sand (KoA)	85	39°51′58″	74°44′08″	0–6	----	----	100
				6–20	----	----	100
				20–84	----	----	100

test data—continued

Test results—Con.								Classification	
Sieve analysis—Con.		Hydrometer analysis		Liquid limit [1]	Plasticity index [2]	Maximum density [3]	Optimum moisture content	AASHO	Unified [4]
Cumulative percentage passing sieve—Con.									
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05–0.005 mm.	<0.005 mm.						
		Percent	*Percent*	*Percent*		*Lb./cu. ft.*	*Percent*		
82	11	-----	-----	NL	NP	-----	-----	A-2-4(0)	SP-SM
79	8	-----	-----	NL	NP	-----	-----	A-3(0)	SP-SM
51	1	-----	-----	NL	NP	-----	-----	A-3(0)	SP
65	3	-----	-----	NL	NP	-----	-----	A-3(0)	SP
79	5	-----	-----	NL	NP	-----	-----	A-3(0)	SP-SM
62	4	-----	-----	NL	NP	-----	-----	A-3(0)	SP
62	1	-----	-----	NL	NP	-----	-----	A-3(0)	SP
50	3	-----	-----	NL	NP	-----	-----	A-1-b(0)	SP
93	7	-----	-----	NL	NP	-----	-----	A-3(0)	SP-SM
92	7	-----	-----	NL	NP	109	14	A-3(0)	SP-SM
94	6	-----	-----	NL	NP	107	14	A-3(0)	SP-SM
96	23	-----	-----	NL	NP	-----	-----	A-2-4(0)	SM
96	29	-----	-----	NL	NP	-----	-----	A-2-4(0)	SM
96	35	19	14	29	8	-----	-----	A-2-4(0)	SM-SC
97	14	-----	-----	NL	NP	-----	-----	A-2-4(0)	SM
88	38	-----	-----	23	4	-----	-----	A-4(1)	SM-SC
92	43	-----	-----	25	5	113	16	A-4(2)	SM-SC
94	46	19	21	30	8	108	19	A-4(2)	SM-SC
77	22	-----	-----	22	3	-----	-----	A-2-4(0)	SM
78	23	-----	-----	22	4	119	13	A-2-4(0)	SM-SC
71	36	18	6	30	8	108	18	A-4(0)	SM-SC
94	83	37	18	49	21	-----	-----	A-7-6(14)	ML-CL
98	84	42	39	50	21	95	24	A-7-6(14)	ML-CL
83	14	-----	-----	NL	NP	-----	-----	A-2-4(0)	SM
84	21	-----	-----	NL	NP	-----	-----	A-2-4(0)	SM
88	36	12	22	38	15	-----	-----	A-6(1)	SM-SC
86	16	-----	-----	NL	NP	-----	-----	A-2-4(0)	SM
90	14	-----	-----	NL	NP	-----	-----	A-2-4(0)	SM
93	37	26	17	23	7	-----	-----	A-4(1)	SM-SC
93	32	10	18	28	9	-----	-----	A-2-4(0)	SC
89	19	-----	-----	NL	NP	-----	-----	A-2-4(0)	SM
76	17	-----	-----	NL	NP	-----	-----	A-2-4(0)	SM
94	40	-----	-----	27	10	-----	-----	A-4(1)	SC
94	17	-----	-----	NL	NP	-----	-----	A-2-4(0)	SM
77	17	-----	-----	NL	NP	-----	-----	A-2-4(0)	SM
84	25	-----	-----	NL	NP	-----	-----	A-2-4(0)	SM
87	32	-----	-----	19	NP	-----	-----	A-2-4(0)	SM
91	9	-----	-----	NL	NP	-----	-----	A-3(0)	SP-SM
74	23	-----	-----	33	6	-----	-----	A-2-4(0)	SM
82	30	17	9	39	13	102	24	A-2-6(1)	SM-SC
76	29	12	17	40	13	104	23	A-2-6(1)	SM-SC
67	36	-----	-----	34	9	-----	-----	A-4(1)	SM-SC
87	79	36	21	44	21	96	25	A-7-6(13)	CL
96	89	27	25	55	22	88	32	A-7-5(16)	MH
96	73	-----	-----	23	4	-----	-----	A-4(8)	ML-CL
96	72	34	36	37	16	120	12	A-6(9)	CL
94	59	28	29	28	9	115	15	A-4(5)	CL
82	6	-----	-----	NL	NP	-----	-----	A-3(0)	SP-SM
86	11	-----	-----	NL	NP	-----	-----	A-2-4(0)	SP-SM
87	10	-----	-----	NL	NP	-----	-----	A-3(0)	SP-SM
87	4	-----	-----	NL	NP	-----	-----	A-3(0)	SP
84	1	-----	-----	NL	NP	-----	-----	A-3(0)	SP
82	6	-----	-----	NL	NP	-----	-----	A-3(0)	SP-SM
89	14	-----	-----	NL	NP	106	13	A-2-4(0)	SM
87	7	-----	-----	NL	NP	106	13	A-3(0)	SP-SM

TABLE 6.—*Engineering*

Soil and symbol	Site number	Sampling site: Latitude	Sampling site: Longitude	Depth	Test results: Sieve analysis: Cumulative percentage passing sieve—: ¾ inch	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)
				Inches			
Klej sand, loamy substratum (KnA)	21	39°45′27″	74°45′09″	0–6			100
				6–23			100
				23–50			100
				50–84			100
Lakehurst sand (LaA) (Gravelly substratum)	32	39°45′55″	74°35′09″	0–10			100
				10–17	100	99	97
				17–40	97	86	82
				40–48	97	79	73
				48–60	100	99	98
Lakehurst sand (LaA) (Modal)	36	39°40′11″	74°30′37″	0–18		100	99
				18–41	100	99	97
				41–69	100	94	88
Lakehurst sand (LaA)	93	39°49′25″	74°32′48″	0–13		100	99
				13–20		100	99
				20–50			100
				50–84		100	99
Lakehurst sand, loamy substratum (LmA).	39	39°47′16″	74°28′33″	0–14			100
				14–38	99	96	92
				38–48	100	99	84
				48–60	100	95	89
				60–84	100	99	97
Lakehurst fine sand (LnA)	24	39°56′42″	74°39′35″	0–12			100
				12–24		100	99
				24–49		100	99
Lakehurst fine sand (LnA) (Modal)	26	39°38′28″	74°36′36″	0–4			100
				4–12			100
				12–28			100
				28–84			100
Lakehurst fine sand, loamy substratum (LoA).	112	39°53′10″	74°48′03″	0–10			100
				10–18			100
				18–84			100
Lakewood sand (LtB) (Gravelly subsoil)	23	39°40′10″	74°38′39″	0–2			100
				2–17	100	95	93
				17–28	94	74	68
				28–60	100	99	99
				60–84	100	99	99
Lakewood sand (LtB) (Gravelly substratum)	31	39°48′20″	74°35′25″	0–8		100	99
				8–16	100	99	97
				16–40	99	94	89
				40–72	96	87	83
				72–84	100	99	98
Lakewood sand (LtB) (Modal)	76	39°48′57″	74°53′59″	0–10			100
				10–21		100	97
				21–40	97	95	92
				40–84		100	99
Lakewood sand, loamy substratum (LvB). (Gravelly subsoil)	22	39°53′35″	74°41′31″	0–4	100	99	98
				4–14	100	99	98
				14–32	97	77	76
				32–44	99	98	93
				44–64	100	99	93
				64–84	100	99	86
Lakewood sand, loamy substratum (LvB). (Modal)	42	39°46′49″	74°26′13″	0–16		100	99
				16–30	100	94	93
				30–48		100	99
				48–84		100	99

test data—continued

Test results—Con.								Classification	
Sieve analysis—Con.		Hydrometer analysis		Liquid limit [1]	Plasticity index [2]	Maximum density [3]	Optimum moisture content	AASHO	Unified [4]
Cumulative percentage passing sieve—Con.									
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05–0.005 mm.	<0.005 mm.						
		Percent	*Percent*	*Percent*		*Lb./cu. ft.*	*Percent*		
92	14			NL	NP			A–2–4(0)	SM
92	12			NL	NP			A–2–4(0)	SP–SM
93	12			NL	NP			A–2–4(0)	SP–SM
93	40			NL	NP			A–4(1)	SM
79	5			NL	NP			A–3(0)	SP–SM
69	4			NL	NP			A–3(0)	SP
60	3			NL	NP			A–3(0)	SP
40	1			NL	NP			A–1–b(0)	SP
93	3			NL	NP			A–3(0)	SP
72	3			NL	NP			A–3(0)	SP
72	1			NL	NP	107	14	A–3(0)	SP
64	3			NL	NP	108	13	A–3(0)	SP
74	3			NL	NP			A–3(0)	SP
74	2			NL	NP			A–3(0)	SP
78	3			NL	NP			A–3(0)	SP
85	4			NL	NP			A–3(0)	SP
56	44			NL	NP			A–3(0)	SP
53	2			NL	NP			A–3(0)	SP
22	0			NL	NP			A–1–b(0)	SP
73	28			25	8			A–2–4(0)	SC
56	0			NL	NP			A–3(0)	SP
76	14			NL	NP			A–2–4(0)	SM
88	16			NL	NP			A–2–4(0)	SM
68	5			NL	NP			A–3(0)	SP–SM
87	1			NL	NP			A–3(0)	SP
84	1			NL	NP			A–3(0)	SP
88	1			NL	NP			A–3(0)	SP
90	1			NL	NP			A–3(0)	SP
96	18			NL	NP			A–2–4(0)	SM
98	16			NL	NP			A–2–4(0)	SM
99	25			NL	NP			A–2–4(0)	SM
75	4			NL	NP			A–3(0)	SP
64	3			NL	NP			A–3(0)	SP
42	1			NL	NP			A–1–b(0)	SP
61	2			NL	NP			A–3(0)	SP
87	2			NL	NP			A–3(0)	SP
67	4			NL	NP			A–3(0)	SP
60	2			NL	NP			A–3(0)	SP
61	1			NL	NP			A–3(0)	SP
51	1			NL	NP			A–3(0)	SP
61	3			NL	NP			A–3(0)	SP
70	2			NL	NP			A–3(0)	SP
63	1			NL	NP			A–3(0)	SP
66	1			NL	NP			A–3(0)	SP
56	1			NL	NP			A–3(0)	SP
73	3			NL	NP			A–3(0)	SP
83	5			NL	NP			A–3(0)	SP–SM
62	2			NL	NP			A–3(0)	SP
71	13			NL	NP			A–2–4(0)	SM
74	17			NL	NP			A–2–4(0)	SM
43	10			NL	NP			A–1–b(0)	SP–SM
87	3			NL	NP			A–3(0)	SP
82	6			NL	NP			A–3(0)	SP–SM
84	16			19	NP			A–2–4(0)	SM
83	13			NL	NP			A–2–4(0)	SM

TABLE 6.—*Engineering*

Soil and symbol	Site number	Sampling site: Latitude	Sampling site: Longitude	Depth	Test results — Sieve analysis — Cumulative percentage passing sieve—: ¾ inch	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)
				Inches			
Lakewood fine sand (LwB)	79	39°52′08″	74°52′06″	0–8			100
				8–16		100	99
				16–29	99	97	96
				29–84			100
Lakewood fine sand (LwB)	81	39°49′57″	74°50′11″	0–6			100
				6–24			100
				24–64		100	99
				64–77		100	98
Lakewood fine sand (LwB) (Modal)	91	39°52′09″	74°35′32″	0–4			100
				4–20			100
				20–38			100
				38–44		100	99
Pasquotank fine sandy loam (Pa) (Thicker solum than in modal)	11	39°54′19″	74°46′10″	0–6	100	99	96
				6–9	100	99	89
				9–48			100
				48–54		100	99
Pasquotank fine sandy loam (Pa) (Thicker solum than in modal)	154	39°57′25″	74°41′42″	0–8			100
				8–24		100	99
				24–46	100	99	98
Pemberton sand (PbA)	133	39°57′02″	74°44′38″	0–7	100	99	98
				7–23			100
				23–41			100
				41–67		100	90
Sassafras fine sandy loam (SgA) (Gravelly substratum)	43	40°05′34″	74°44′21″	0–6			100
				6–28			100
				28–44	95	89	84
Sassafras fine sandy loam (SgA) (Thinner solum than in modal)	53	39°58′44″	74°54′05″	0–7		100	90
				7–22			100
				22–42	95	91	87
				42–84		100	94
Sassafras fine sandy loam (SgA) (Modal)	117	39°48′30″	74°43′54″	0–2			100
				2–16			100
				16–36			100
				36–55			100
Shrewsbury fine sandy loam (Sn) (Modal)	146	40°02′03″	74°47′24″	0–7			100
				7–14			100
				14–29			100
				29–36	99	99	99
Shrewsbury fine sandy loam (Sn) (Subsoil finer textured than in (Modal)	157	39°57′06″	74°42′33″	0–9			100
				9–19			100
				19–28		100	99
				28–40		100	99
				40–53		100	99
Tinton sand (TsB)	78	39°55′47″	74°52′52″	0–4			100
				4–19			100
				19–48			100
				48–60		100	99
Tinton sand (TsB) (Modal)	98	40°08′03″	74°37′08″	0–15			100
				15–28			100
				28–40			100
				40–51			100
				51–60			100
Westphalia fine sandy loam (WdB)	107	39°52′49″	74°55′17″	0–5	99	96	95
				5–12	99	95	92
				12–36		100	98
				36–48	99	97	96
				48–56	92	82	76

test data—continued

Test results—Con.								Classification	
Sieve analysis—Con.		Hydrometer analysis		Liquid limit [1]	Plasticity index [2]	Maximum density [3]	Optimum moisture content	AASHO	Unified [4]
Cumulative percentage passing sieve—Con.									
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05–0.005 mm.	<0.005 mm.						
		Percent	*Percent*	*Percent*		*Lb./cu. ft.*	*Percent*		
90	5	----	----	NL	NP	----	----	A-3(0)	SP-SM
89	4	----	----	NL	NP	----	----	A-3(0)	SP
82	3	----	----	NL	NP	----	----	A-3(0)	SP
93	4	----	----	NL	NP	----	----	A-3(0)	SP
88	3	----	----	NL	NP	----	----	A-3(0)	SP
88	3	----	----	NL	NP	----	----	A-3(0)	SP
86	2	----	----	NL	NP	----	----	A-3(0)	SP
72	1	----	----	NL	NP	----	----	A-3(0)	SP
84	3	----	----	NL	NP	----	----	A-3(0)	SP
86	4	----	----	NL	NP	----	----	A-3(0)	SP
84	4	----	----	NL	NP	----	----	A-3(0)	SP
84	2	----	----	NL	NP	----	----	A-3(0)	SP
72	22	----	----	NL	NP	----	----	A-2-4(0)	SM
62	11	----	----	NL	NP	----	----	A-2-4(0)	SP-SM
77	24	----	----	NL	NP	----	----	A-2-4(0)	SM
75	4	----	----	NL	NP	----	----	A-3(0)	SP
78	36	----	----	43	9	----	----	A-5(1)	SM
68	44	23	7	29	6	102	19	A-4(2)	SM-SC
90	59	----	----	23	3	113	14	A-4(5)	ML
70	16	----	----	NL	NP	----	----	A-2-4(0)	SM
92	20	----	----	20	NP	----	----	A-2-4(0)	SM
94	29	----	----	NL	NP	----	----	A-2-4(0)	SM
78	21	----	----	25	6	----	----	A-2-4(0)	SM-SC
99	40	----	----	17	3	----	----	A-4(1)	SM
93	46	28	13	21	8	----	----	A-4(2)	SC
45	15	----	----	19	4	----	----	A-2-b(0)	SM-SC
84	43	----	----	21	3	----	----	A-4(2)	SM
88	45	----	----	24	8	----	----	A-4(2)	SC
67	22	----	----	21	5	----	----	A-2-4(0)	SM-SC
29	1	----	----	NL	NP	----	----	A-1-b(0)	SP
82	43	----	----	NL	NP	----	----	A-4(2)	SM
88	48	----	----	21	4	----	----	A-4(3)	SM-SC
89	58	----	----	25	4	----	----	A-4(5)	ML-CL
82	27	----	----	NL	NP	----	----	A-2-4(0)	SM
80	41	----	----	49	12	----	----	A-7-5(2)	SM
87	56	33	20	43	20	----	----	A-7-6(9)	CL
94	67	38	22	39	6	----	----	A-4(6)	ML
76	43	31	12	23	8	----	----	A-4(2)	SC
88	50	----	----	31	8	----	----	A-4(3)	ML-CL
96	67	----	----	26	5	----	----	A-4(6)	ML-CL
93	58	----	----	NL	NP	----	----	A-4(5)	ML
79	20	----	----	37	11	102	21	A-2-6(1)	SM-SC
82	30	----	----	44	15	93	28	A-2-7(0)	SM
96	12	----	----	NL	NP	----	----	A-2-4(0)	SP-SM
97	10	----	----	NL	NP	----	----	A-3(0)	SP-SM
97	28	11	11	28	8	----	----	A-2-4(0)	SM-SC
93	7	----	----	NL	NP	----	----	A-3(0)	SP-SM
87	19	----	----	NL	NP	----	----	A-2-4(0)	SM
84	14	----	----	NL	NP	----	----	A-2-4(0)	SM
85	34	17	17	36	11	----	----	A-2-6(0)	SM-SC
85	19	----	----	26	3	----	----	A-2-4(0)	SM
91	42	----	----	23	4	----	----	A-4(1)	SM-SC
86	32	----	----	24	5	----	----	A-2-4(0)	SM-SC
81	41	----	----	20	NP	----	----	A-4(1)	SM
90	56	----	----	NL	NP	----	----	A-4(4)	ML
80	22	----	----	NL	NP	----	----	A-2-4(0)	SM
38	10	----	----	NL	NP	----	----	A-1-b(0)	SP-SM

TABLE 6.—*Engineering*

Soil and symbol	Site number	Sampling site: Latitude	Sampling site: Longitude	Depth	Test results — Sieve analysis — Cumulative percentage passing sieve—: ¾ inch	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)
				Inches			
Woodmansie sand (WeB)	3	39°40′17″	74°25′50″	0–12	----	----	100
				12–34	----	100	99
				34–60	100	99	99
				60–84	----	----	100
Woodmansie sand (WeB) (Modal)	159	39°41′00″	74°25′10″	0–16	100	76	69
				16–28	100	86	82
				28–51	100	97	93
				51–84	100	99	98
Woodstown loamy sand (WkA) (Thicker solum than in modal)	4	39°45′27″	74°24′48″	0–7	100	99	98
				7–26	99	94	92
				26–72	95	60	54
Woodstown fine sandy loam (WmA)	73	40°00′00″	74°55′18″	0–7	100	97	97
				7–18	----	----	100
				18–25	----	----	100
				25–48	97	94	92

[1] NL means nonliquid.
[2] NP means nonplastic.
[3] Based on AASHO Designation T99–57, Method C (*1*).

TABLE 7.—*Estimated engin*

Soils and map symbols	Depth to seasonal high water table	Depth from surface of typical profile	Classification: Dominant USDA texture	Unified	AASHO	Percentage: No. 4 (4.7 mm.)	No. 10 (2.0 mm.)
	Feet	*Inches*					
Adelphia fine sandy loam: AaA, AaB. Adelphia loam: AhA. Adelphia sandy clay loam, truncated: Ak.	1–2	0–14	Fine sandy loam or loam.	SM, SC, ML, CL	A–2, A–4	98–100	95–100
		14–30	Sandy clay loam	SM, SC, ML, CL	A–2, A–4, A–6	98–100	95–100
		30–60	Loamy sand and sandy loam.	SM, SC	A–2	98–100	95–100
Adelphia fine sandy loam, clayey substratum: AcA, AcB. Adelphia fine sandy loam, glauconitic variant: AnA, AnB.	1–2	0–14	Fine sandy loam	SM	A–2, A–4, A–7	98–100	95–100
		14–30	Sandy clay loam	SM, SC, ML, CL	A–2, A–4, A–6	98–100	95–100
		30–40	Loamy sand and sandy loam.	SM	A–2, A–4	98–100	95–100
		40–60	Clay or sandy clay loam.[3]	ML, CL	A–6, A–7	98–100	95–100
Alluvial land, loamy: Ao.	0–3	0–60	Loam, sandy loam, clay loam, sandy clay loam [3].	SM, SC, ML, CL	A–2, A–5, A–7, A–4	95–100	90–100
Alluvial land, sandy: Ap.	[illegible]	0–60	Sand	SM, SP–SM	A–2, A–3	90–100	85–100
Atsion sand: At.	1	0–60	Sand or loamy sand	SP, SP–SM	A–3	98–100	95–100
Atsion sand, loamy substratum: Au.	1	0–40	Sand or loamy sand	SP, SP–SM	A–3	98–100	95–100
		40–60	Sandy loam or sandy clay loam.	SM or SC	A–2 or A–4	90–100	70–90
Atsion fine sand: Av.	1	0–24	Fine sand or loamy fine sand.	SP, SP–SM	A–3	98–100	98–100
		24–60	Fine sand or sand	SP, SP–SM	A–3	95–100	90–100
Atsion fine sand, loamy substratum: Aw.	1	0–24	Fine sand or loamy fine sand.	SP, SP–SM	A–3	95–100	95–100
		24–40	Fine sand	SP, SP–SM	A–3	95–100	90–100
		40–60	Sandy loam or sandy clay loam.	SM or SC	A–2, A–4	95–100	95–100

test data—continued

Sieve analysis—Con. Cumulative percentage passing sieve—Con. No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Hydrometer analysis 0.05–0.005 mm.	<0.005 mm.	Liquid limit [1]	Plasticity index [2]	Maximum density [3]	Optimum moisture content	Classification AASHO	Unified [4]
		Percent	*Percent*	*Percent*		*Lb./cu. ft.*	*Percent*		
85	13			NL	NP			A-2-4(0)	SM
89	19			NL	NP			A-2-4(0)	SM
84	23			NL	NP			A-2-4(0)	SM
83	22			NL	NP			A-2-4(0)	SM
38	5			NL	NP			A-1-b(0)	SP-SM
54	21			30	12	117	13	A-2-6(0)	SC
66	20			30	12	115	15	A-2-6(0)	SC
58	16			24	7	123	10	A-2-4(0)	SM-SC
79	16			NL	NP			A-2-4(0)	SM
72	24			NL	NP			A-2-4(0)	SM
47	6			NL	NP			A-1-b(0)	SP-SM
86	48			25	7			A-4(3)	SM-SC
94	58			NL	NP			A-4(5)	ML
94	53			21	6			A-4(4)	ML-CL
74	22			NL	NP			A-2-4(0)	SM

[4] The Soil Conservation Service and the Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within two points from the A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are SM-SC and ML-CL.

eering properties of soils

passing sieve— No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit [1]	Plasticity index [2]	Permeability	Available water capacity	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential
		Percent		*Inches per hour*	*Inches per inch depth*	*Percent dry wt.*	*Pounds per cubic foot*	
85–95	25–60	NL–32	NP–10	0.2 –2.0	0.19–0.23	12–18	110–120	Low.
85–95	30–65	22–40	8–18	0.2 –2.0	0.19–0.23	15–25	100–110	Low.
80–95	15–35	NL–22	NP–10	0.63–6.3+	0.14–0.18	15–25	100–110	Low.
75–95	25–50	NL–42	NP–12	0.2 –2.0	0.18–0.20	15–20	110–115	Low.
85–95	30–55	30–35	8–12	0.2 –0.63	0.18–0.20	15–25	100–110	Low.
85–95	15–35	NL–25	NP–12	0.63–6.3+	0.18–0.20	15–20	100–110	Low.
90–100	50–75	30–50	10–14	<0.2	0.22–0.24	15–25	90–100	Moderate.
50–100	20–85	(4)	(4)	(4)	(4)	(4)	(4)	Low to moderate.
80–100	5–15	NL	NP	>6.3	0.05–0.08	10–15	105–115	Low.
50–90	0–10	NL	NP	2.0 –6.3+	0.06–0.12	10–15	110–120	Low.
50–90	0–10	NL	NP	2.0 –6.3+	0.08–0.12	10–15	110–120	Low.
30–40	30–40	NL	NP	0.63–2.0	0.12–0.18	12–18	110–120	Moderate.
90–100	2–10	NL	NP	2.0 –6.3	0.10–0.12	10–15	100–110	Low.
50–80	0–10	NL	NP	>6.3	0.08–0.10	10–15	100–110	Low.
90–100	2–10	NL	NP	2.0 –6.3	0.10–0.12	10–15	100–110	Low.
50–95	0–10	NL	NP	>6.3	0.08–0.10	10–15	100–110	Low.
90–100	20–40	NL–30	NP–10	0.63–2.0	0.12–0.18	12–18	110–120	Low.

TABLE 7.—*Estimated engineering*

Soils and map symbols	Depth to seasonal high water table	Depth from surface of typical profile	Classification			Percentage	
			Dominant USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)
	Feet	*Inches*					
Berryland sand: Bp.	0	0–60	Sand	SP, SP–SM	A–3	98–100	95–100
Berryland fine sand: Bt.	0	0–60	Fine sand or loamy fine sand.	SP, SP–SM	A–3	98–100	95–100
Berryland mucky sand: Bu.	0	0–10	Muck	Pt	-----	100	100
		10–60	Loamy sand or sand.	SP, SP–SM	A–3	90–100	90–100
Colemantown loam: Cm.	0–1	0–16	Loam, sandy clay loam.	SC, ML, CL	A–2, A–4, A–7	100	98–100
		16–34	Sandy clay, clay loam.[3]	ML, CL, MH, CH	A–7	100	98–100
		34–60	Sandy loam and clay loam.[3]	SC, SM, ML	A–4, A–6, A–7	95–100	95–100
Collington fine sandy loam: CnA, CnB, CnC.	>5	0–14	Fine sandy loam or loam.	SM, SC, ML	A–2, A–4	98–100	95–100
Collington loam: CoA, CoB.		14–38	Loam, fine sandy clay loam.	SM, SC, CL	A–4	98–100	95–100
		38–60	Alternating loamy sand and sandy loam.	SM, SC	A–2, A–3, A–4	95–100	95–100
Donlonton fine sandy loam: DeB.	1–2	0–10	Loam or fine sandy loam.	SM, SC, ML, CL	A–4	98–100	95–100
Donlonton loam: DlA.		10–36	Clay loam	ML, CL	A–4, A–6, A–7	100	95–100
		36–60	Alternating sandy loam and clay loam.	ML, CL, SM, SC	A–2, A–4, A–6	90–100	80–100
Downer loamy sand: DoA, DoB, DoC.	>5	0–17	Loamy sand	SP–SM, SM	A–2	95–100	90–100
Downer sandy loam, truncated: DsB.		17–28	Sandy loam	SM	A–2	95–100	90–100
		28–60	Sand, gravelly sand	SP, SP–SM	A–2	90–100	80–100
Downer loamy sand, gravelly substratum: DpB.	>5	0–17	Loamy sand	SP–SM, SM	A–2	95–100	90–100
		17–28	Sandy loam	SM	A–2	95–100	90–100
		28–52	Gravelly sand	GP, SM, SP–SM	A–1	40–70	30–70
Downer loamy sand, loamy substratum: DrA.	>5	0–17	Loamy sand	SP–SM, SM	A–2	95–100	90–100
		17–28	Sandy loam	SM	A–2	95–100	90–100
		28–40	Sand	SP, SP–SM	A–2	90–100	80–100
		40–60	Sandy clay loam	SM, SC	A–2, A–4	90–100	90–100
Evesboro sand: EvB, EvC. Evesboro fine sand: EyB.	>5	0–60	Fine sand or sand	SP, SP–SM	A–3	98–100	95–100
Evesboro sand, loamy substratum: EwB.	>5	0–40	Sand	SP, SP–SM	A–3	95–100	90–100
		40–60	Sandy loam or sandy clay loam.	SM, SC	A–2, A–4	95–100	95–100
Fallsington fine sandy loam: Fa.	0–1	0–34	Fine sandy loam	SM, SC	A–2, A–4	95–100	95–100
		34–60	Sand and loamy sand.	SM, SP–SM	A–2, A–3	90–100	90–100
Fallsington fine sandy loam, clayey substratum: Fc.	0–1	0–40	Fine sandy loam	SM, SC	A–2, A–4	95–100	95–100
		40–60	Sandy clay loam	SC, SM	A–2, A–4	90–100	90–100
Freehold fine sandy loam: FfA, FfB, FfC, FfD, FfE.	>5	0–15	Fine sandy loam	SM, SM–SC	A–2, A–4	100	98–100
		15–35	Sandy clay loam or sandy loam.	SM, SC	A–2, A–4	100	98–100
Freehold sandy loam: FoC3, FoD3.		35–60	Alternating loamy sand and fine sandy loam.	SM	A–2	95–100	95–100
Freehold fine sandy loam, clayey substratum: FgB.	>5	0–15	Fine sandy loam	SM, SM–SC	A–2, A–4	100	98–100
		15–35	Sandy clay loam or sandy loam.	SM, SC	A–2, A–4	100	98–100
		35–40	Alternating loamy sand and fine sandy loam.	SM	A–2	95–100	95–100
		40–60	Sandy clay or clay	SC, ML, CL	A–4, A–6	98–100	95–100

properties of soils—continued

passing sieve—		Liquid limit [1]	Plasticity index [2]	Permeability	Available water capacity	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)							
		Percent		*Inches per hour*	*Inches per inch depth*	*Percent dry wt.*	*Pounds per cubic foot*	
50–90	0–10	NL	NP	2.0 –6.3+	0.10–0.12	10–15	110–120	Low.
90–100	2–10	NL	NP	2.0 –6.3+	0.12–0.14	10–15	110–120	Low.
95–100	80–100	------	------	0.63–2.0	0.25–0.35	-----	-------	High.
50–80	2–10	NL	NP	2.0 –6.3	0.06–0.11	10–15	110–120	Low.
90–100	40–90	30–45	10–20	0.2 –2.0	0.22–0.24	20–40	100–110	Low.
90–100	55–90	45–55	15–25	<0.2	0.22–0.24	25–40	90–100	Moderate.
85–100	40–80	25–50	5–15	0.2 –0.63	0.16–0.20	15–30	90–110	Moderate.
85–95	30–60	NL–32	NP–10	0.63–6.3	0.20–0.24	12–18	110–120	Low.
85–95	35–65	20–40	NP–16	0.2 –0.63	0.18–0.22	15–20	105–115	Low to moderate.
85–95	10–50	NL–32	NP–10	0.63–6.3	0.14–0.18	12–20	110–120	Low.
80–100	40–70	20–40	NP–12	0.2 –0.63	0.22–0.24	20–40	100–110	Low.
90–100	50–95	30–70	4–32	<0.2	0.20–0.22	30–40	85–100	Moderate.
60–100	20–85	NL–34	NP–14	0.2 –0.63	0.16–0.20	20–40	90–110	Low.
60–90	10–20	NL	NP	0.63–6.3	0.09–0.11	10–15	110–120	Low.
60–90	20–30	20–30	0–5	0.63–2.0	0.09–0.11	12–18	110–120	Low.
40–90	10–20	NL	NP	2.0 –6.3+	0.07–0.09	10–15	110–120	Low.
60–90	10–20	NL	NP	0.63–6.3	0.09–0.11	10–15	110–120	Low.
60–90	20–30	20–30	0–5	0.63–2.0	0.09–0.11	12–18	110–120	Low.
20–45	10–20	NL	NP	>6.3	0.04–0.06	10–15	115–125	Low.
60–90	10–20	NL	NP	0.63–6.3	0.09–0.11	10–15	110–120	Low.
60–90	20–30	20–30	0–5	0.63–2.0	0.09–0.11	12–18	110–120	Low.
40–90	10–20	NL	NP	2.0 –6.3+	0.07–0.09	10–15	110–120	Low.
80–100	30–50	20–30	5–10	0.63–2.0	0.14–0.18	12–18	110–120	Low.
50–100	1–12	NL	NP	2.0 –6.3+	0.07–0.10	10–15	105–115	Low.
50–90	1–12	NL	NP	>6.3	0.07–0.09	10–15	105–115	Low.
90–100	20–50	20–30	5–10	0.63–2.0	0.14–0.18	12–18	110–120	Low.
70–100	30–45	16–22	5–10	0.63–2.0	0.16–0.18	15–20	110–120	Low.
60–90	10–25	12–18	5–8	2.0 –6.3+	0.10–0.12	12–18	110–120	Low.
70–100	30–45	16–22	5–10	0.63–2.0	0.16–0.18	15–20	110–120	Low.
70–90	30–50	25–40	4–8	0.2 –2.0	0.14–0.18	18–24	100–115	Low.
80–95	20–40	NL–25	NP–7	0.2 –6.3+	0.18–0.20	15–20	110–120	Low.
85–95	30–50	NL–30	NP–10	0.2 –6.3+	0.18–0.20	15–20	110–120	Low.
75–95	15–30	NL–25	NP–6	0.63–6.3+	0.14–0.18	10–15	110–120	Low.
80–95	20–40	NL–25	NP–7	0.2 –6.3+	0.18–0.20	15–20	110–120	Low.
85–95	30–50	NL–30	NP–10	0.2 –6.3+	0.18–0.20	15–20	110–120	Low.
75–95	15–30	NL–25	NP–6	0.63–6.3+	0.14–0.18	10–15	110–120	Low.
80–100	40–80	30–50	10–20	<0.2	0.20–0.24	30–40	90–100	Moderate.

TABLE 7.—*Estimated engineering*

Soils and map symbols	Depth to seasonal high water table	Depth from surface of typical profile	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO	Percentage: No. 4 (4.7 mm.)	Percentage: No. 10 (2.0 mm.)
	Feet	*Inches*					
Freehold loamy sand: FhB, FhC.	>5	0–18	Loamy sand	SM, SP–SM	A–2, A–3	100	98–100
		18–32	Sandy loam or sandy clay loam.	SM, SC	A–2	100	98–100
		32–60	Loamy sand and sandy loam.	SP–SM, SM	A–2, A–3	95–100	90–100
Galestown sand: GaA.	>5	0–60	Sand or loamy sand	SM, SP–SM	A–2, A–3	100	98–100
Galestown sand, clayey substratum: GcB.	>5	0–40	Sand or loamy sand	SM, SP–SM	A–2, A–3	100	98–100
		40–60	Sandy clay or clay	SC, ML, CL	A–4, A–6	100	98–100
Holmdel fine sandy loam: HdA, HdB. Holmdel-Urban land complex: Hn. (Applies only to the Holmdel soil.)	1–2½	0–10	Fine sandy loam	SM, SM–SC	A–2, A–4	100	98–100
		10–34	Sandy loam or sandy clay loam.	SM, SC	A–2, A–4	100	98–100
		34–60	Alternating sandy loam and loamy sand.	SM	A–2	100	95–100
Holmdel loamy sand: HlB.	1–2½	0–18	Loamy sand	SM, SP–SM	A–2	100	98–100
		18–32	Sandy loam or sandy clay loam.	SM, SC	A–2	100	98–100
		32–60	Alternating loamy sand and sandy loam.	SM	A–2, A–3	100	98–100
Holmdel fine sandy loam, clayey substratum: HmA, HmB.	1–2½	0–10	Fine sandy loam	SM, SM–SC	A–2, A–4	100	98–100
		10–34	Sandy loam or sandy clay loam.	SM, SC	A–2, A–4	100	98–100
		34–40	Alternating sandy loam and loamy sand.	SM	A–2	100	95–100
		40–60	Sandy clay or clay	SC, ML, CL	A–4, A–6	100	95–100
Keansburg fine sandy loam: Ka.	0	0–15	Fine sandy loam	SM, SM–SC	A–2, A–4	95–100	90–100
		15–30	Fine sandy loam	SM, SC	A–2, A–4	95–100	95–100
		30–60	Alternating sand and sandy loam.	SM, SP–SM	A–2	100	95–100
Keyport loamy sand: KeB.	1½–2½	0–16	Loamy sand	SM, SC	A–2, A–4	100	95–100
		16–60	Clay loam	CL, ML, CH	A–6, A–7	100	100
Keyport fine sandy loam: KfB. Keyport loam: KlA, KlB, KlC, KlD, KlE.	1½–2½	0–16	Loam or fine sandy loam.	SM, SC, ML, CL	A–4	100	98–100
		16–60	Clay loam	ML, CL, MH	A–4, A–6	100	98–100
Klej sand: KmA. Klej fine sand: KoA.	1–2½	0–60	Sand or fine sand	SP, SM, SP–SM	A–3, A–2	100	90–100
Klej sand, loamy substratum: KnA.	1–2½	0–40	Sand	SP, SM, SP–SM	A–3, A–2	100	90–100
		40–60	Sandy clay or sandy clay loam.	SM, SC, CL, ML	A–2, A–4, A–6	100	90–100
Kresson loamy sand: KwA.	1–2	0–15	Loamy sand	SM, SP–SM	A–2	100	90–100
		15–30	Sandy clay, sandy clay loam.	CL, CH, ML, MH	A–6, A–7	100	98–100
		30–60	Alternating layers of sandy loam and sandy clay loam.	SM, SC, CL, ML	A–4, A–6, A–7	100	100
Kresson fine sandy loam: KxA. Kresson loam: KyA.	1–2	0–8	Fine sandy loam or loam.	SM, ML, CL	A–2, A–4, A–7	90–100	80–100
		8–36	Sandy clay, sandy clay loam.[3]	CL, CH, ML, MH	A–6, A–7	100	98–100
		36–60	Alternating layers of sandy loam and sandy clay loam.[3]	SC, SM, CL, ML	A–4, A–6, A–7	100	100

properties of soils—continued

passing sieve—		Liquid limit [1]	Plasticity index [2]	Permeability	Available water capacity	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)							
		Percent		*Inches per hour*	*Inches per inch depth*	*Percent dry wt.*	*Pounds per cubic foot*	
70–90	5–20	NL	NP	0.63–6.3	0.13–0.15	10–15	110–120	Low.
70–90	15–35	NL–30	NP–10	0.63–2.0	0.13–0.15	15–20	108–115	Low.
60–90	10–25	NL	NP	2.0 –6.3+	0.10–0.14	10–15	110–120	Low.
80–95	5–15	NL	NP	2.0 –6.3+	0.08–0.10	8–15	108–115	Low.
80–95	5–15	NL	NP	2.0 –6.3+	0.08–0.10	8–15	108–115	Low.
80–95	40–80	30–50	10–20	<0.2	0.20–0.24	30–40	90–100	Moderate.
85–95	20–40	NL–28	NP–7	0.2 –6.3	0.18–0.20	15–20	108–115	Low.
85–95	30–50	25–40	5–15	0.2–0.63	0.18–0.20	15–20	108–115	Low.
80–95	15–30	NL	NP	0.63–6.3	0.10–0.14	10–15	110–120	Low.
75–90	10–20	NL–25	NP–5	0.63–6.3+	0.13–0.15	10–15	110–120	Low.
85–95	15–35	NL–30	NP–10	0.63–2.0	0.13–0.15	15–20	108–115	Low.
85–95	15–30	NL–25	NP–6	2.0 –6.3+	0.10–0.14	10–15	110–120	Low.
85–95	20–40	NL–28	NP–7	0.2 –6.3	0.18–0.20	15–20	108–115	Low.
85–95	30–50	25–40	5–15	0.2 –0.63	0.18–0.20	15–20	108–115	Low.
80–95	15–30	NL	NP	0.63–6.3	0.10–0.14	10–15	110–120	Low.
85–95	40–80	30–50	10–20	<0.2	0.20–0.24	30–40	90–100	Moderate.
75–85	20–40	NL–32	NP–6	0.63–2.0	0.24–0.26	15–20	110–120	Low.
80–90	25–45	20–40	10–15	0.63–2.0	0.18–0.22	20–30	100–120	Low.
75–90	10–30	NL–30	NP–10	0.63–2.0	0.14–0.18	15–25	100–120	Low.
90–100	15–40	NL	NP	2.0 –6.3	0.12–0.16	10–15	110–120	Low.
98–100	65–90	40–60	20–30	<0.2	0.16–0.18	25–35	95–105	Moderate.
85–95	40–85	30–40	4–12	0.2 –0.63	0.20–0.24	20–35	80–120	Moderate.
85–95	65–90	30–50	10–25	<0.2	0.18–0.20	20–40	80–100	Moderate.
60–90	2–15	NL	NP	>6.3	0.08–0.10	10–15	105–120	Low.
60–90	2–15	NL	NP	>6.3	0.08–0.10	10–15	110–120	Low.
60–90	30–60	20–30	5–10	<0.2	0.14–0.18	20–30	100–110	Moderate.
70–90	10–20	NL	NP	0.2 –2.0	0.14–0.16	10–15	110–120	Low.
80–95	50–90	35–60	10–25	<0.2	0.16–0.18	30–50	85–95	Moderate.
80–100	40–80	30–50	10–20	0.2 –0.63	0.16–0.20	20–35	90–110	Moderate.
70–90	20–70	30–45	8–15	0.2 –0.63	0.19–0.22	20–35	90–100	Moderate.
80–95	50–95	35–60	10–25	>0.2	0.16–0.18	30–40	85–95	Moderate.
80–100	40–80	30–50	10–20	0.2–0.63	0.16–0.20	20–35	90–110	Moderate.

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TABLE 7.—*Estimated engineering*

Soils and map symbols	Depth to seasonal high water table	Depth from surface of typical profile	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO	Percentage: No. 4 (4.7 mm.)	Percentage: No. 10 (2.0 mm.)
	Feet	*Inches*					
Lakehurst sand: LaA. Lakehurst sand, thick surface: LlA. Lakehurst fine sand: LnA. Lakehurst-Lakewood sands: LrA. (For Lakewood part of Lsa, see LvB).	1–3 2–5 (LrA)	0–60	Sand or fine sand	SP, SP–SM	A–3	95–100	95–100
Lakehurst sand, loamy substratum: LmA. Lakehurst fine sand, loamy substratum: LoA. Lakehurst-Lakewood sands, loamy substratum: LsA. (For Lakewood part of LsA, see LvB.	1–3 1–5 (LsA)	0–40	Sand or fine sand	SP	A–3	95–100	95–100
		40–60	Sandy loam or sandy clay loam.	SM, SC	A–2, A–4	100	100
Lakewood sand: LtB, LtC, LtD. Lakewood sand, thick surface: LuB. Lakewood fine sand: LwB.	>5	0–60	Sand or fine sand	SP, SP–SM	A–3	90–100	85–100
Lakewood sand, loamy substratum: LvB. Lakewood fine sand, loamy substratum: LyA.	>5	0–40	Sand or fine sand	SP, SP–SM	A–3	90–100	85–100
		40–60	Sandy loam	SM	A–2	100	90–100
Marlton fine sandy loam: MhA, MhB. Marlton soils: MrC.	2–5	0–10	Fine sandy loam	SM, SC	A–2, A–4	90–100	80–100
		10–40	Sandy clay, clay loam.[3]	ML, CL, MH, CH	A–2, A–6, A–7	90–100	85–100
		40–60	Alternating sandy loam and sandy clay loam.[3]	SM, SC, ML, CL	A–2, A–4, A–6	95–100	90–100
Nixonton fine sandy loam: NbA, NbB.	1½–2½	0–12	Fine sandy loam	SM	A–2, A–4	95–100	90–100
		12–32	Very fine sandy loam.	SM	A–4	95–100	90–100
		32–60	Alternating loamy fine sand and fine sandy loam.	SM	A–2	90–100	85–95
Nixonton loamy fine sand: NcA, NcB.	1½–2½	0–18	Loamy fine sand	SP–SM, SM	A–2	95–100	90–100
		18–30	Very fine sandy loam.	SM	A–2, A–4	95–100	90–100
		30–60	Alternating loamy fine sand and sandy loam.	SM	A–2	90–100	85–95
Pasquotank fine sandy loam: Pa.	0–1	0–30	Fine sandy loam, very fine sandy loam.	SM	A–2, A–4	98–100	90–100
		30–60	Alternating loamy sand, sand and sandy loam.	SM, SP	A–2	98–100	95–100
Pemberton sand: PbA.	1–2½	0–24	Sand or loamy sand	SM, SP–SM	A–2, A–3	100	100
		24–34	Fine sandy loam	SM, SM–SC	A–2	100	100
		34–60	Sand and sandy loam.	SM	A–2, A–4	100	98–100
Pemberton sand, thick surface: PcA.	1–2½	0–34	Sand	SP–SM	A–2, A–3	100	100
		34–44	Fine sandy loam	SM, SM–SC	A–2	100	100
		44–60	Alternating sand and sandy loam.	SM	A–2, A–4	100	95–100
Pits, sand and gravel: Pt.	0–5	0–60	Sand or gravelly sand.	SP, SP–SM	A–3	50–100	40–90

properties of soils—continued

passing sieve—		Liquid limit [1]	Plasticity index [2]	Permeability	Available water capacity	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)							
		Percent		*Inches per hour*	*Inches per inch depth*	*Percent dry wt.*	*Pounds per cubic foot*	
40–95	0–5	NL	NP	>6.3	0.06–0.09	10–15	105–115	Low
40–90	0–5	NL	NP	>6.3	0.06–0.09	10–15	105–115	Low.
60–90	20–50	20–30	5–10	2.0 –6.3	0.12–0.16	15–25	110–120	Low.
40–75	1–10	NL	NP	>6.3	0.06–0.09	10–15	105–115	Low.
40–95	1–10	NL	NP	>6.3	0.06–0.09	10–15	105–115	Low.
60–90	20–35	20–30	5–10	2.0 –6.3	0.12–0.16	15–25	110–120	Low.
65–95	20–50	25–35	5–10	0.2 –2.0	0.19–0.21	20–35	110–120	Low.
70–95	50–80	35–60	10–25	<0.2	0.17–0.19	10–30	95–115	Moderate.
70–90	20–60	NL–60	NP–30	0.2 –0.63	0.16–0.20	10–20	100–120	Moderate.
80–95	30–45	20–30	0–5	0.2 –2.0	0.21–0.23	15–20	110–120	Low.
80–95	35–50	20–30	0–5	0.2 –2.0	0.17–0.21	15–20	110–120	Low.
70–90	15–30	NL–25	NP–7	0.63–2.0	0.10–0.14	10–15	105–115	Low.
80–95	10–30	20–28	0–5	0.2 –6.3+	0.14–0.16	10–15	100–110	Low.
80–95	30–45	20–30	0–5	0.2 –2.0	0.14–0.16	15–20	110–120	Low.
70–90	20–35	NL–25	NP–7	0.63–2.0	0.10–0.14	10–15	100–110	Low.
70–95	20–45	NL–45	NP–10	0.63–2.0	0.18–0.22	15–25	110–120	Low.
75–95	10–30	NL–25	NP–5	0.63–2.0	0.10–0.14	10–15	110–120	Low.
80–100	5–20	NL	NP	2.0 –6.3+	0.12–0.14	10–15	100–110	Low.
90–100	25–35	25–35	8–12	0.63–2.0	0.14–0.18	10–15	110–120	Low.
80–95	10–30	NL–30	NP–8	2.0 –6.3	0.12–0.16	10–15	100–110	Low.
80–100	5–12	NL	NP	>6.3	0.12–0.14	10–15	100–110	Low.
90–100	25–35	25–35	8–12	2.0 –6.3	0.14–0.18	10–15	110–120	Low.
90–100	10–30	NL–30	NP–8	>6.3	0.12–0.16	10–15	100–110	Low.
30–80	0–10	NL	NP	>6.3	0.05–0.08	10–15	1[illegible]–120	Low.

TABLE 7.—*Estimated engineering*

Soils and map symbols	Depth to seasonal high water table	Depth from surface of typical profile	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO	Percentage: No. 4 (4.7 mm.)	Percentage: No. 10 (2.0 mm.)
	Feet	*Inches*					
Pits, clay and marl: Pu.	5	0–60	Clay or clay loam	CL, CH	A–6, A–7	100	80–100
Pocomoke fine sandy loam: Pv.	0	0–28	Fine sandy loam	SM	A–2, A–4	95–100	90–100
		28–60	Alternating sand and sandy loam.	SM, SP–SM	A–2, A–3	90–100	90–100
Sandy land, ironstone: Se.	5	0–15	Sand	SP–SM	A–2, A–3	95–100	95–100
		15–24	Ironstone				
		24–60	Sand	SP–SM	A–2, A–3	95–100	95–100
Sassafras loamy sand: SfB.	>5	0–18	Loamy sand	SM	A–2	90–100	90–100
		18–30	Sandy loam	SM	A–2, A–4	90–100	80–100
		30–60	Loamy sand or gravelly loamy sand.	SM	A–2	80–100	70–90
Sassafras fine sandy loam: SgA, SgB, SgC.	>5	0–14	Fine sandy loam	SM	A–2, A–4	80–100	80–100
Sassafras-Urban land complex: Sk.		14–34	Fine sandy loam, loam, or sandy clay loam.	SM, SC, ML	A–2, A–4	90–100	85–100
(Where horizons have not been destroyed. Where destroyed, characteristics similar to Urban land, sandy, Ug)		34–60	Loamy sand or gravelly loamy sand.	SM	A–2	70–100	60–90
Sassafras fine sandy loam, clayey substratum: ShA, ShB.	>5 [5]	0–14	Fine sandy loam	SM	A–2, A–4	80–100	80–100
Sassafras-Urban land complex, clayey substrata: Sm.		14–34	Fine sandy loam, loam, or sandy clay loam.	SM, SC, ML	A–2, A–4	90–100	85–100
(Where horizons have not been destroyed.)		34–40	Loamy sand or gravelly loamy sand.	SM	A–2	70–100	60–90
		40–60	Sandy clay loam	SM, SC, ML	A–2, A–4	90–100	80–100
Shrewsbury fine sandy loam: Sn.	1	0–14	Fine sandy loam or loam.	SM, SC, ML	A–2, A–4	100	98–100
Shrewsbury loam: Sp.		14–32	Fine sandy clay loam.	SM, SC, ML	A–2, A–4	100	98–100
Shrewsbury sandy clay loam, truncated: Sv.		32–60	Alternating loamy sand and sandy loam [3].	SM, SC	A–2, A–4	100	98–100
Shrewsbury fine sandy loam, clayey substratum: So.	1	0–14	Fine sandy loam or or loam.	SM, SC, ML	A–2, A–4	100	98–100
		14–32	Fine sandy clay loam.	SM, SC, ML	A–2, A–4	100	98–100
		32–40	Alternating loamy sand and sandy loam.[3]	SM, SC	A–2, A–4	100	98–100
		40–60	Sandy clay [3]	CL, ML, MH	A–6, A–7	100	100
Shrewsbury fine sandy loam, ironstone variant: Sx.	1	0–18	Fine sandy loam, loam.	SM, SC, ML	A–2, A–4	100	98–100
		18–24	Indurated loam				
		24–60	Alternating loam and sandy loam.[3]	SM, SC	A–2, A–4	100	98–100
Tinton sand: TsB, TsC.	>5	0–24	Sand or loamy sand	SM, SP–SM	A–2, A–3	100	100
		24–38	Fine sandy loam	SM, SM–SC	A–2	100	100
		38–60	Sand and sandy loam.	SM	A–2, A–4	100	98–100
Tinton sand, thick surface: TtB.	>5	0–35	Sand	SM, SP–SM	A–2, A–3	100	100
		35–45	Fine sandy loam	SM, SM–SC	A–2	100	100
		45–60	Alternating sand and sandy loam.	SM	A–2, A–4	100	95–100
Urban land, sandy: Ug.	>5	0–60	Loamy sand or sandy loam.	SM, SP–SM	A–2, A–3	90–100	85–100

properties of soils—continued

passing sieve—		Liquid limit [1]	Plasticity index [2]	Permeability	Available water capacity	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)							
		Percent		*Inches per hour*	*Inches per inch depth*	*Percent dry wt.*	*Pounds per cubic foot*	
80–100	60–90	------	------	<0.2	0.16–0.20	20–35	90–100	Moderate.
60–80	20–45	20–30	0–8	0.63–2.0	0.18–0.24	15–20	110–120	Low.
50–80	10–30	NL–30	NP–10	2.0 –6.3	0.10–0.14	10–15	110–120	Low.
80–100	5–12	NL	NP	>6.3	0.07–0.09	10–15	110–120	Low.
70–90	5–12	NL	NP	>6.3	0.07–0.09	10–15	110–120	Low.
70–90	12–25	NL	NP	0.63–6.3+	0.11–0.13	10–15	100–110	Low.
70–90	20–40	18–25	3–7	0.63–2.0	0.12–0.14	10–15	115–125	Low.
50–80	15–25	NL–20	NP–5	2. 0–6.3+	0.10–0.14	10–15	120–130	Low.
60–90	20–45	NL–25	NP–5	0.2 –6.3+	0.14–0.16	15–20	110–120	Low.
50–90	25–60	17–27	5–10	0.63–2.0	0.13–0.15	15–20	115–125	Low.
30–70	15–25	NL–20	NP–5	2. 0–6.3+	0.10–0.14	10–15	120–130	Low.
60–90	20–45	NL–25	NP–5	0.2 –6.3+	0.14–0.16	15–20	110–120	Low.
50–90	25–60	17–27	5–10	0.63–2.0	0.13–0.15	15–20	115–125	Low.
30–70	15–25	NL–20	NP–5	2. 0–6.3+	0.10–0.14	10–15	120–130	Low.
70–100	30–60	30–40	10–15	0.2 –2.0	0.16–0.20	20–30	100–120	Low.
80–90	25–60	30–50	10–20	0.63–2.0	0.20–0.22	15–25	90–110	Low.
90–100	30–70	25–40	5–15	0.63–2.0	0.18–0.20	15–25	90–110	Low.
75–95	20–45	NL–45	NP–15	2.0 –6.3	0.14–0.18	20–30	95–105	Low.
80–90	25–60	30–50	10–20	0.63–2.0	0.20–0.22	15–25	90–110	Low.
90–100	30–70	25–40	5–15	0.63–2.0	0.18–0.20	15–25	90–110	Low.
75–95	20–45	NL–45	NP–15	2.0 –6.3	0.14–0.18	20–30	95–105	Low.
85–100	60–80	30–45	15–20	<0.2	0.18–0.22	25–35	90–100	Moderate.
80–90	25–55	20–30	5–10	0.63–2.0	0.18–0.20	15–20	105–115	Low.
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80–100	20–45	NL–35	NP–15	2.0 –6.3	0.18–0.22	10–20	100–115	Low.
80–100	5–20	NL	NP	2.0 –6.3+	0.12–0.14	10–15	100–110	Low.
90–100	25–35	25–35	8–12	2.0 –6.3	0.14–0.18	10–15	110–120	Low.
80–95	10–40	NL–30	NP–6	2.0 –6.3	0.12–0.16	10–15	100–110	Low.
80–100	5–20	NL	NP	>6.3	0.12–0.14	10–15	100–110	Low.
90–100	25–35	25–35	8–12	2.0 –6.3	0.14–0.18	10–15	110–120	Low.
90–100	10–40	NL–30	NP–6	>6.3	0.12–0.16	10–15	100–110	Low.
80–100	5–25	NL	NP	2.0 –6.3	0.06–0.14	10–20	110–120	Low.

TABLE 7.—*Estimated engineering*

Soils and map symbols	Depth to seasonal high water table	Depth from surface of typical profile	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO	Percentage: No. 4 (4.7 mm.)	Percentage: No. 10 (2.0 mm.)
	Feet	*Inches*					
Urban land, clayey: Ut.	>5	0–60	Clay, silty clay, clay loam.	CL, CH	A–6, A–7	100	90–100
Urban land, sandy over clayey: Uv.	>5	0–30	Sandy loam, loamy sand.	SM, SP–SM	A–2, A–3	90–100	85–100
		30–60	Clay or clay loam	CL, ML	A–6, A–7	90–100	85–100
Westphalia loamy fine sand: WaA, WaB.	>5	0–15	Loamy fine sand	SM	A–2	95–100	95–100
		15–30	Very fine sandy loam.	SM	A–2, A–4	95–100	95–100
		30–60	Alternating fine sand and fine sandy loam.	SM, SP–SM	A–2	90–100	80–100
Westphalia fine sandy loam: WdA, WdB.	>5	0–13	Fine sandy loam	SM	A–2, A–4	95–100	95–100
		13–30	Very fine sandy loam.	SM	A–2, A–4	95–100	95–100
		30–60	Alternating fine sand and fine sandy loam.	SM, SP–SM	A–2	90–100	80–100
Woodmansie sand: WeB, WeC.	>5	0–17	Sand or loamy sand	SM, SP–SM	A–2, A–3	80–95	70–100
		17–30	Sandy loam	SM, SC	A–2	85–100	80–100
		30–60	Alternating gravelly sand and loamy sand.	SM, SP–SM	A–2, A–3	60–100	50–100
Woodmansie sand, firm substratum: WgB.	>5	0–17	Sand or loamy sand	SM, SP–SM	A–2, A–3	80–95	70–100
		17–30	Sandy loam	SM, SC	A–2	85–100	80–100
		30–60	Sandy clay loam, gravelly sandy clay loam.	SC, ML	A–4	60–90	50–80
Woodmansie sand, loamy substratum: WhB.	>5	0–17	Sand or loamy sand	SM, SP–SM	A–2, A–3	80–95	70–100
		17–30	Sandy loam	SM, SC	A–2	85–100	80–100
		30–40	Alternating gravelly sand and loamy sand.	SM, SP–SM	A–2, A–3	60–100	50–100
		40–60	Sandy clay loam	SM, SC, ML	A–4, A–6	70–100	60–90
Woodstown loamy sand: WkA.	1½–2½	0–18	Loamy sand	SM	A–2	95–100	95–100
		18–30	Sandy loam	SM, SC	A–2, A–4	95–100	95–100
		30–60	Loamy sand and sandy loam.	SM, SP–SM	A–2, A–4	90–100	90–100
Woodstown loamy sand, loamy substratum: WlA.	1½–2½	0–18	Loamy sand	SM	A–2	95–100	95–100
		18–30	Sandy loam	SM	A–2, A–4	95–100	95–100
		30–40	Loamy sand and sandy loam.	SM, SP–SM	A–2, A–4	90–100	90–100
		40–60	Sandy clay loam	SM, SC, ML	A–4, A–6	90–100	85–100
Woodstown fine sandy loam: WmA, WmB.	1½–2½	0–34	Fine sandy loam, loam or sandy clay loam.	SM, SC, ML	A–2, A–4	95–100	95–100
		34–60	Loamy sand	SM, SP–SM	A–2, A–4	90–100	85–100
Woodstown fine sandy loam, clayey substratum: WnA, WnB.	1½–2½	0–34	Fine sandy loam, loam, or sandy clay loam.	SM, SC, ML	A–2, A–4	95–100	95–100
		34–40	Loamy sand	SM, SP–SM	A–2, A–4	90–100	85–100
		40–60	Clay or clay loam	CL, CH, MH	A–6, A–7	90–100	90–100

[1] NL means nonliquid.
[2] NP means nonplastic.
[3] This material contains large amounts of glauconite that occur in sand-sized granules that break down to clay size with continued crushing and agitation. For this reason, the sieve-size data and the Unified and AASHO classifications depend on the method and procedure of laboratory tests. The USDA texture was estimated in the field without excessive rubbing of the

properties of soils—continued

passing sieve—		Liquid limit [1]	Plasticity index [2]	Permeability	Available water capacity	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)							
		Percent		*Inches per hour*	*Inches per inch depth*	*Percent dry wt.*	*Pounds per cubic foot*	
80–100	60–90	------	------	<0.2	0.16–0.20	25–35	90–100	Moderate.
80–100	5–15	NL	NP	2.0 –6.3	0.06–0.14	10–20	110–120	Low.
80–100	50–80	------	------	0.2 –0.63	0.14–0.18	25–35	90–100	Moderate.
80–90	15–25	NL	NP	0.2 –2.0	0.12–0.14	10–15	100–110	Low.
70–90	20–35	NL	NP–5	0.2 –2.0	0.15–0.17	15–20	105–115	Low.
60–90	10–30	NL	NP	0.63–6.3	0.12–0.16	10–20	100–115	Low.
80–90	20–30	NL–25	NP–5	0.2 –2.0	0.20–0.22	15–20	105–115	Low.
70–90	25–35	NL–25	NP–5	0.2 –2.0	0.16–0.18	15–20	105–115	Low.
70–90	10–20	NL	NP	0.63–6.3	0.12–0.16	10–15	100–110	Low.
40–90	5–15	NL	NP	>6.3	0.06–0.08	10–15	100–110	Low.
50–90	15–25	25–35	10–15	2.0 –6.3	0.12–0.16	10–15	105–115	Low.
50–90	5–25	NL–25	NP–5	>6.3	0.08–0.12	10–15	100–110	Low.
40–90	5–15	NL	NP	>6.3	0.06–0.08	10–15	100–110	Low.
50–90	15–25	25–35	10–15	2.0 –6.3	0.12–0.16	10–15	105–115	Low.
50–70	40–70	30–40	8–12	0.2 –0.63	0.06–0.08	20–25	110–120	Moderate.
40–90	5–15	NL	NP	>6.3	0.06–0.08	10–15	100–110	Low.
50–90	15–25	25–35	10–15	2.0 –6.3	0.12–0.16	10–15	105–115	Low.
50–90	5–25	NL–25	NP–5	>6.3	0.08–0.12	10–15	100–110	Low.
50–80	40–60	30–40	8–12	0.2 –2.0	0.14–0.18	15–20	110–120	Moderate.
85–95	15–25	NL–25	NP–5	0.63–6.3+	0.12–0.14	10–15	110–120	Low.
85–95	20–40	25–30	5–10	0.63–2.0	0.14–0.18	15–20	115–125	Low.
40–90	10–40	NL–25	NP–5	0.63–2.0	0.10–0.14	10–15	110–120	Low.
85–95	15–25	NL–25	NP–5	0.63–6.3+	0.12–0.14	10–15	110–120	Low.
85–95	20–40	25–30	NP–5	0.63–2.0	0.14–0.18	15–20	115–125	Low.
40–90	10–40	NL–25	NP–5	0.63–2.0	0.10–0.14	10–15	110–120	Low.
60–90	40–70	30–40	8–12	0.63–2.0	0.18–0.22	15–20	105–115	Moderate.
85–95	20–60	NL–35	NP–10	0.2 –6.3	0.16–0.18	10–15	115–130	Low.
40–90	10–40	NL–30	NP–15	0.63–2.0	0.10–0.14	10–15	115–125	Low.
85–95	20–60	NL–35	NP–10	0.2 –6.3	0.16–0.18	10–15	115–130	Low.
40–90	10–40	NL–30	NP–15	0.63–2.0	0.10–0.14	10–15	115–125	Low.
90–100	60–90	45–55	20–30	<0.2	0.18–0.22	25–30	90–100	Moderate.

soil material. Permeability may be much slower than indicated, and available water capacity may be considerably higher than indicated.

[4] Variable.

[5] Except for short periods.

TABLE 8.—*Engineering interpre*

Soils and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Sand and gravel	Road fill
Adelphia fine sandy loam: AaA, AaB. Adelphia loam: AhA. Adelphia sandy clay loam, truncated: Ak.	Fair: seasonal water table moderately high.	Severe for AhA, Ak.	Good for AaA, AaB, AhA: water table moderately high in winter and spring; poor for Ak: topsoil removed.	Fair for sand: fine sand interbedded with fines below depth of 30 inches; unsuitable for gravel.	Good to fair: A–2, A–4, or A–6.
Adelphia fine sandy loam, clayey substratum: AcA, AcB. Adelphia fine sandy loam, glauconitic variant: Ana, AnB.	Fair: seasonal water table moderately high.	Severe	Good: water table moderately high in winter and spring.	Unsuitable for sand and gravel.	Fair: A–2 or A–4 to depth of 40 inches, A–6 or A–7 below.
Alluvial land, loamy: Ao.	Poor to good: high water table.	Severe	Poor to good: seasonal water table high.	Unsuitable: subject to stream overflow.	Fair to poor: A–2, A–4, A–6 or A–7; seasonal water table high in most places.
Alluvial land, sandy: Ap.	Poor: seasonal water table at surface.	Moderate: water table provides moisture.	Poor: low fertility; low available water capacity.	Poor for sand: seasonal water table at surface.	Good (A2): if soil binder is added, good (A–3); water table constantly high.
Atsion sand: At. Atsion sand, loamy substratum: Au. Atsion fine sand: Av. Atsion fine sand, loamy substratum: Aw.	Poor: seasonal water table high.	Moderate: water table provides moisture.	Poor: low fertility; low available water capacity, moderate organic-matter content, seasonal water table high.	Good for medium and coarse sand: seasonal water table high, unsuitable for gravel: beds thin or too variable to predict occurrence.	Fair: if soil binder is added, good (A–3); water table seasonally high.
Berryland sand: Bp. Berryland fine sand: Bt.	Poor: seasonal water table high.	Moderate: water table provides moisture.	Poor: low fertility; low available water capacity, seasonal water table high, organic-matter content high.	Good for medium and coarse sand: seasonal water table high; unsuitable for gravel.	Fair: if soil binder is added, good A–3); seasonal water table high.
Berryland mucky sand: Bu.	Poor: seasonal water table high.	Severe	Fair: low fertility, high available water capacity, organic-matter content high, seasonal water table high.	Fair for sand below depth of 10 inches; seasonal water table high.	Fair: A–3 below depth of 1 foot, needs binder, seasonal water table high.

tations of the soils

Soil features affecting—						
Road location	Reservoirs			Drainage	Irrigation	Grassed waterways
	Reservoir area	Embankment	Dugout			
Seasonal water table moderately high; frost-heave hazard.	Permeable substratum; seasonal water table moderately high.	Fair stability; impervious when compacted.	Seasonal water table moderately high.	Permeability moderately slow in surface layer and subsoil and moderate in substratum; seasonal water table moderately high.	Moderately high available water capacity.	([1]).
Plastic substratum below depth of 40 inches; frost-heave hazard.	Slowly permeable substratum; seasonal water table moderately high.	Good stability to depth of 40 inches; plastic material below depth of 40 inches.	Recharge rate slow.	Permeability moderately slow in subsoil and slow in substratum; seasonal water table moderately high.	Moderately high available water capacity.	([1]).
Subject to frequent stream overflow, water table does not drop much in summer.	Permeability variable; seasonal water table high in most places.	Material generally suitable but fairly variable.	Recharge rate rapid in most places; subject to stream overflow.	Water table high throughout year.	([3])	([2]).
Seasonal water table at surface and does not drop much in summer; subject to frequent stream overflow.	Coarse material rapidly permeable; water table high.	Coarse material rapidly permeable.	Recharge rate rapid.	Subject to stream overflow.	Water table high throughout year.	([2]).
Seasonal water table high, flooding hazard in places.	Permeable substratum, seasonal water table high.	Rapid permeability; little cohesion, fair stability.	Recharge rate rapid, water table high.	Moderately rapid permeability, suitable for drainage if water table is controlled.	Seasonal water table high, infiltration rapid.	([2]).
Seasonal water table high, flooding hazard in places.	Permeable substratum, seasonal water table high.	Rapid permeability, little cohesion, fair stability.	Recharge rate rapid, water table high.	Seasonal water table high, moderately rapid permeability, suitable for drainage if water table is controlled, ditches in fine sand subject to severe piping.	Seasonal water table high, infiltration rapid in sand, moderately rapid in fine sand.	([2]).
Seasonal water table high, flooding hazard.	Permeable substratum, seasonal water table high.	Moderately rapid permeability, low cohesion.	Recharge rate rapid, seasonal water table high.	Moderately rapid permeability; seasonal high water table.	Seasonal water table high.	([2]).

TABLE 8.—*Engineering interpre*

Soils and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Sand and gravel	Road fill
Colemantown loam: Cm.	Poor: very plastic subsoil.	Severe	Fair in top foot: seasonal water table high in winter and spring.	Unsuitable for sand and gravel.	Poor: highly plastic wet, A–6 or A–7.
Collington fine sandy loam: CnA, CnB, CnC. Collington loam: CoA, CoB.	Fair	Moderate for CnA, CnB, CnC; severe for CoA, CoB.	Good in top foot	Fair for fine sand below depth of 38 inches, interbedded with fines; unsuitable for gravel.	Fair: A–2 or A–4.
Donlonton fine sandy loam: DeB. Donlonton loam: DlA.	Poor: plastic subsoil, seasonal water table moderately high.	Severe	Good in top foot: excess soil moisture in winter and spring.	Unsuitable for sand and gravel.	Poor: A–4, A–6, or A–7, plastic material, moderately wet.
Downer loamy sand: DoA, DoB, DoC. Downer loamy sand, loamy substratum: DrA. Downer sandy loam, truncated: DsB.	Good	Slight	Fair: low fertility, low available water capacity.	Good for sand below depth of 30 inches, chiefly medium and coarse; poor for gravel.	Good: A–2 or A–4.
Downer loamy sand, gravelly substratum: DpB.	Good	Slight	Fair: low fertility, low available water capacity.	Good for rounded quartzose gravel and sand between depths of 30 and 50 inches, sand below 50 inches.	Good: A–1 or A–2.
Evesboro sand: EvB, EvC. Evesboro sand, loamy substratum: EwB. Evesboro fine sand: EyB.	Good	Slight	Poor: low fertility, low available water capacity, subject to soil blowing.	Good for sand, dominantly fine in EyB; unsuitable for gravel.	Fair: if soil binder is added, good (A–3).
Fallsington fine sandy loam: Fa.	Poor: seasonal water table high.	Severe: seasonal water table high.	Fair: excess soil water restricts operations to summer.	Fair for sand below depth of 30 inches, seasonal water table high; poor for gravel.	Good: A–2 or A–4, seasonal water table high.
Fallsington fine sandy loam, clayey substratum: Fc.	Poor: seasonal water table high.	Severe: seasonal water table high.	Fair: excess soil water restricts operations to summer.	Unsuitable for sand and gravel.	Fair: A–2 or A–4 to depth of 30 inches, poor plastic material below.
Freehold fine sandy loam: FfA, FfB, FfC, FfD, FfE. Freehold sandy loam: FoC3, FoD3.	Good	Moderate	Good in top foot, except poor for FoC3 and FoD3	Fair for fine sand below depth of 30 inches, but interbedded with fines.	Good: A–2 or A–4.

tations of the soils—continued

Soil features affecting—						
Road location	Reservoirs			Drainage	Irrigation	Grassed waterways
	Reservoir area	Embankment	Dugout			
Plastic material, seasonal water table high.	Slow seepage, seasonal water table high.	Subject to cracking, low strength and stability.	Recharge rate variable.	Slow permeability, slow surface drainage, ponded water on surface.	Slow intake rate, subject to surface ponding.	(1).
Frost-heave potential moderate to high.	Permeable substratum, water table low.	Fairly stable, impervious when compacted.	(2)	(2)	Moderately slow intake rate, high available water capacity.	(1).
Plastic material; subject to frost heave.	Slow seepage; seasonal water table moderately high.	Plastic material	Seepage variable, recharge rate variable, fluctuating water level.	Slow permeability in surface layer and subsoil, some sandy layers in substratum, ponding a hazard in depressions.	High available water capacity, ponding a hazard, slow intake rate.	Ponding a hazard.
(1)	Rapidly permeable substratum; water table low.	Sandy material; rapid seepage rate; difficult to vegetate.	(2)	(2)	Low available water capacity, moderate intake rate.	Low fertility and available water capacity.
(1)	Rapidly permeable substratum, water table low.	Sandy material, rapid seepage rate, difficult to vegetate.	(2)	(2)	Low available water capacity, moderate intake rate.	Low fertility and available water capacity.
Subject to soil blowing; unsuitable unless confined; loose sand hinders hauling.	Very permeable material, water table low.	Very permeable material, fine sand subject to piping.	(2)	(2)	Low available water capacity, low fertility.	Low fertility and available water capacity, highly erodible.
Seasonal water table high; flooding hazards in places.	Permeable substratum, high seasonal water table.	Moderately permeable, needs compaction and close control, stability fair.	Seasonal water table high.	Seasonal water table high; moderate permeability, sandy substratum.	Seasonal water table high; moderate available water capacity.	(1).
Seasonal water table high; flooding hazards in places.	Slow seepage, seasonal water table high.	Substratum material slowly permeable.	Seasonal water table high.	Moderate permeability, clayey substratum.	Seasonal water table high, moderate available water capacity.	(1).
(1)	Substratum permeable, water table low.	Moderately permeable, impervious when compacted, stability fair.	Substratum permeable, water table low.	(2)	High available water capacity, water intake rate variable and depends on compaction.	(1).

TABLE 8.—*Engineering interpre*

Soils and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Sand and gravel	Road fill
Freehold fine sandy loam, clayey substratum: FgB.	Good	Slight to moderate.	Good in top foot	Unsuitable for sand and gravel.	Fair: A–2 or A–4 to depth of 40 inches, A–4 or A–6 below.
Freehold loamy sand: FhB, FhC.	Good	Slight	Fair in top 1½ feet: low available water capacity.	Fair for fine sand below depth of 30 inches, but interbedded with fines.	Fair: A–2 or A–3; A–3 good if binder is added.
Freehold fine sandy loam (with (X) symbol).	Good	Moderate	Good in top foot	Fair for fine sand below depth of 10 inches.	Fair: A–2 or A–3; A–3 good if binder is added.
Galestown sand: GaA.	Good	Slight	Poor: low fertility, low available water capacity.	Good for fine sand below depth of 40 inches; unsuitable for gravel except close to Delaware River.	Fair: if soil binder is added, good (A–3).
Galestown sand, clayey substratum: GcB.	Good	Slight	Poor: low fertility, low available water capacity.	Unsuitable for sand and gravel.	Fair: A–3 to depth of 40 inches, A–4 or A–6 below.
Holmdel fine sandy loam: HdA, HdB. Holmdel-Urban land: Hn. (Urban land in Hn variable)	Fair: seasonal water table moderately high.	Severe	Good: excess soil moisture in winter and spring.	Fair for fine sand below depth of 30 inches, but interbedded with fines; unsuitable for gravel.	Good: A–2 or A–4; seasonal water table moderately high.
Holmdel loamy sand: HlB.	Good	Moderate	Fair: low available water capacity, low fertility, seasonal water table moderately high.	Fair for fine sand below depth of 30 inches, but interbedded with fines.	Good: A–2 or A–4; seasonal water table moderately high.
Holmdel fine sandy loam, clayey substratum: HmA, HmB.	Fair: seasonal water table moderately high.	Severe	Good: excess soil moisture in winter and spring.	Unsuitable for sand and gravel.	Good: A–2 or A–4 to depth of 40 inches, poor below (A–4 or A–6).
Keansburg fine sandy loam: Ka.	Poor: seasonal water table high.	Severe: seasonal water table high.	Fair: seasonal water table high.	Unsuitable for sand and gravel.	Good: A–2 or A–4; seasonal water table high.

tations of the soils—continued

Soil features affecting—						
Road location	Reservoirs			Drainage	Irrigation	Grassed waterways
	Reservoir area	Embankment	Dugout			
Plastic material below depth of 40 inches.	Slow seepage	Subsoil permeable, substratum plastic.	Substratum slowly permeable, water table low.	(2)	High available water capacity, water intake rate variable and depends on compaction.	(1).
(1)	Substratum permeable, water table low.	Moderately permeable, needs compaction and close control; stability fair.	Substratum permeable, water table low.	(2)	Moderate available water capacity, intake rate moderate.	Low available water capacity, erosion hazard high on strong slopes.
(1)	Substratum permeable, water table low.	Permeable material, subject to piping.	Substratum permeable, water table low.	(2)	Low available water capacity, intake rate variable and depends on compaction.	Low available water capacity.
(1)	Substratum permeable, water table low.	Rapidly permeable material, subject to piping.	(3)	(2)	Low available water capacity, intake rate moderate.	Low fertility and available water capacity, hazard of soil blowing high.
Substratum plastic.	Slow seepage, water table low.	Rapidly permeable material to depth of 40 inches, slowly permeable below 40 inches.	Water table low.	(2)	Low available water capacity, intake rate moderate.	Low fertility and available water capacity, hazard of soil blowing high.
Seasonal water table moderately high; frost-heave hazard.	Substratum permeable, seasonal water table moderately high.	Moderately permeable material needs compaction.	Seasonal water table moderately high, recharge rate normally high.	Permeability moderately slow in solum, moderate in substratum; seasonal water table moderately high.	High available water capacity, intake rate moderately slow.	Seasonal water table moderately high.
Seasonal water table moderately high.	Substratum permeable, seasonal water table moderately high.	Moderately permeable material needs compaction and careful control.	Recharge rate normally high, seasonal water table moderately high.	Permeability moderately slow in subsoil, moderate in substratum; seasonal water table moderately high.	Moderate available water capacity, intake rate moderate.	Low fertility, seasonal water table moderately high; hazard of erosion high on slopes.
Seasonal water table moderately high; plastic substratum.	Slow seepage, seasonal water table moderately high.	Sandy clay loam subsoil over clayey substratum; mixing of subsoil and substratum material desirable.	Recharge rate slow, seasonal water table moderately high.	Permeability moderately slow in subsoil, slow in substratum; seasonal water table moderately high.	High available water capacity, intake rate moderately slow.	Seasonal water table moderately high.
Seasonal water table high; flooding hazard.	Substratum moderately permeable, seasonal water table high.	Moderately permeable material needs compaction.	Recharge rate rapid in most places, seasonal water table high.	Permeability is moderate.	Seasonal water table high, high available water capacity.	(3).

TABLE 8.—*Engineering interpre*

Soils and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Sand and gravel	Road fill
Keyport loamy sand: KeB. Keyport fine sandy loam: KfB. Keyport loam: KlA, KlB, KlC, KlD, KlE.	Poor: subsoil material plastic.	Severe	Fair in top foot: excess soil moisture in winter and spring.	Unsuitable for sand and gravel.	Poor: plastic material, A–4 or A–6 or A–7.
Klej sand: KmA. Klej fine sand: KoA.	Fair: seasonal water table moderately high.	Slight	Poor: low fertility, low available water capacity.	Good for sand: water table seasonally high; unsuitable for gravel.	Fair: A–2 or A–3; A–3 good if soil binder is added; water table seasonally high.
Klej sand, loamy substratum: KnA.	Fair: seasonal water table moderately high.	Slight	Poor: low fertility, low available water capacity.	Unsuitable for sand and gravel.	Fair: A–2 or A–3 to depth of 40 inches, A–4 or A–6 below.
Kresson loamy sand: KwA.	Poor: plastic material, seasonal water table moderately high.	Moderate	Fair in top foot	Unsuitable for sand and gravel.	Poor: A–4 or A–6 or A–7; seasonal water table moderately high.
Kresson fine sandy loam: KxA. Kresson loam: KyA.	Poor: plastic material, seasonal water table moderately high.	Severe	Good in top foot: excess soil water in winter and spring may hamper operations.	Unsuitable for sand and gravel.	Poor: A–4 or A–6 or A–7, seasonal water table moderately high.
Lakehurst sand: LaA. Lakehurst sand, thick surface: LlA. Lakehurst fine sand: LnA. Lakehurst-Lakewood sands: LrA. (For Lakewood part in LrA, refer to LtB.).	Good	Slight	Poor: very low fertility, very low available water capacity.	Good: fine sand in LnA; unsuitable for gravel.	Fair: if soil binder is added, good (A–3).
Lakehurst sand, loamy substratum: LmA. Lakehurst fine sand, loamy substratum: LoA. Lakehurst-Lakewood sands, loamy substratum: LsA. (For Lakewood part of LsA, refer to LtB).	Good	Slight	Poor: very low fertility, very low available water capacity.	Good to fair for sand, but mixed with fines; unsuitable for gravel.	Fair: A–3 and A–2, A–3 good if soil binder is added.
Lakewood sand: LtB, LtC, LtD. Lakewood sand, thick surface: LuB. Lakewood fine sand: LwB.	Good	Slight	Poor: very low fertility, very low available water capacity.	Good for sand but mixed with fines; unsuitable for gravel.	Fair: if binder is added, good (A–3).

tations of the soils—continued

Soil features affecting—						
Road location	Reservoirs			Drainage	Irrigation	Grassed waterways
	Reservoir area	Embankment	Dugout			
Plastic material, frost-heave potential high, contains seeps in places.	Slow seepage	Compaction fair to good, stability fair.	Recharge rate slow, ground water in lower strata.	Permeability slow in subsoil and lower substratum, moderate in sandy strata where present; seasonal water table moderately high.	High available water capacity, intake rate slow.	Erosion a hazard on steep slopes.
Seasonal water table moderately high.	Substratum permeable material.	Rapidly permeable material.	Recharge rate rapid, seasonal water table moderately high.	Rapid permeability, seasonal water table moderately high.	Available water capacity low, seasonal water table moderately high.	Low fertility and available water capacity, seasonal water table moderately high.
Seasonal water table moderately high.	Slow seepage	Fine sand over clayey substratum; mixing of solum and underlying material desirable.	Recharge rate slow, seasonal water table moderately high.	Rapid permeability, seasonal water table moderately high.	Available water capacity low, seasonal water table moderately high.	Low fertility and available water capacity, seasonal water table moderately high.
Plastic material, frost-heave potential high, seasonal water table moderately high.	Slow seepage, seasonal water table moderately high.	Loamy sand over sandy clay subsoil; mixing of plastic subsoil and sandier material desirable.	Recharge rate variable, seasonal water table moderately high.	Permeability slow in subsoil and moderately slow in substratum.	Low available water capacity in surface layer, high in subsoil, intake rate moderate.	Available water capacity low in surface layer.
Plastic material, frost-heave potential high, seasonal water table moderately high.	Slow seepage, seasonal water table moderately high.	Plastic subsoil over sandy loam and sandy clay loam substratum; mixing of plastic subsoil and sandier material desirable.	Recharge rate variable, seasonal water table moderately high.	Permeability slow in subsoil and moderately slow in substratum, hazard of surface ponding.	Available water capacity high, intake rate slow.	Ponding hazard in depressed areas.
Loose sand hinders hauling, seasonal water table moderately high.	Substratum rapidly permeable, seasonal water table moderately high.	Sandy material, rapid seepage rate, difficult to vegetate, fine sands subject to piping.	Seasonal water table moderately high, level drops in summer.	(2)	(2)	Very low fertility and available water capacity, severe soil blowing.
Loose sand hinders hauling, seasonal water table moderately high.	Substratum permeable to slowly permeable, seasonal water table moderately high.	Sand and fine sand over loamy substratum; mixing of solum and substratum desirable.	Seasonal water table moderately high, level drops in summer.	(2)	(2)	Very low fertility and available water capacity, severe soil blowing.
Loose sand hinders hauling, subject to soil blowing.	Substratum rapidly permeable, water table low.	Sandy material, rapidly permeable, difficult to vegetate.	(2)	(2)	(2)	Very low fertility and available water capacity, severe soil blowing.

TABLE 8.—*Engineering interpre*

Soils and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Sand and gravel	Road fill
Lakewood sand, loamy substratum: LvB. Lakewood fine sand, loamy substratum: LyA.	Good	Slight	Poor: very low fertility, very low available water capacity.	Fair for sand mixed with fines; unsuitable for gravel.	Fair: A–3 and A–2; A–3 good if binder is added.
Made land, dredged coarse material: Ma.	Good	Slight	Poor: low fertility, low available water capacity.	Good for sand of variable size; fair for gravel and cobblestones.	Fair: A–2 or A–3; A–3 good if soil binder is added.
Made land, dredged fine material: Mf.	Poor: plastic material.	Severe	Poor: high clay content.	Unsuitable for sand and gravel.	Poor: A–6 or A–7, plastic material.
Made land, sanitary fill: Mg.	Variable	Variable	Unsuitable: mixed with debris.	Unsuitable	Unsuitable
Marlton fine sandy loam: MhA, MhB. Marlton soils: MrC.	Poor: plastic subsoil.	Severe	Fair in top foot, clayey in some places.	Unsuitable for sand and gravel.	Poor to fair in subsoil: A–4, A–6, or A–7, highly plastic.
Marsh, fresh water: Ms.	(²)	(²)	Poor: surface ponded except for short periods in dry years.	(²)	(²)
Marsh, tidal: Mt.	Poor: daily flooding.	Severe	Poor: daily flooding.	Poor for sand, 2 to 10 feet of organic silt overburden: unsuitable for gravel.	Unsuitable: highly organic material.
Muck, shallow: Mu.	Poor: water table constantly high.	Severe	Poor: highly organic material, water table constantly high.	Poor for sand, about 2 feet of organic matter overburden.	Unsuitable: highly organic material.
Nixonton fine sandy loam: NbA, NbB. Nixonton loamy fine sand: NcA, NcB.	Fair: seasonal water table moderately high.	Severe for NbA, NbB: seasonal water table moderately high, moderate for NcA, NcB.	Good in top foot: seasonal water table moderately high.	Fair, fine sand at depth below 2½ feet in most places; unsuitable for gravel.	Good: A–2 or A–4, seasonal water table moderately high.
Pasquotank fine sandy loam: Pa.	Poor: seasonal water table high.	Severe: seasonal water table high.	Fair in top foot: seasonal water table high.	Fair for sand below depth of 2½ feet; poor for gravel, quantity low, occurrence unpredictable.	Good: A–2 or A–4, seasonal water table high.

tations of the soils—continued

Soil features affecting—						
Road location	Reservoirs: Reservoir area	Reservoirs: Embankment	Reservoirs: Dugout	Drainage	Irrigation	Grassed waterways
Loose sand hinders hauling, subject to soil blowing.	Substratum permeable or slowly permeable.	Sand over loamy substratum; mixing of solum and substratum desirable.	([2])	([2])	([2])	Very low fertility and available water capacity, severe soil blowing.
Loose sand hinders hauling, subject to soil blowing.	([2])	Material rapidly permeable.	([2])	([2])	([2])	Very low fertility, loose material subject to soil blowing and water erosion.
Plastic material, frost heave severe.	Slow seepage	Plastic material, low strength and stability, subject to cracking.	Slow seepage	([2])	([2])	Low organic-matter content, plastic material.
Unstable material, subject to uneven settling.	Unsuitable	Unsuitable	Unsuitable	([2])	([2])	Thickness of soil material limited.
Subsoil highly plastic, subject to frost heave, slowly permeable.	Slow seepage	Subsoil highly plastic, substratum less plastic.	Water table low.	Permeability slow in subsoil.	High available water capacity, permeability slow in subsoil, ponding hazard in level areas.	Hazard of ponding on low slopes.
([2])	([1])	([2])	([2])	([2])	([2])	([2]).
Stability poor, subject to daily flooding.	Slow seepage	Poor stability and shear strength.	Subject to flooding.	([2])	([2])	([2]).
Unstable material, subject to subsidence and severe frost heave.	([2])	([2])	([1])	([2])	([2])	([2]).
Seasonal water table moderately high, hazard of frost heave high.	Substratum permeable, seasonal water table moderately high.	Subject to piping, mixed soil materials permeable.	Seasonal water table moderately high, normal level below depth of 5 feet in summer.	Permeability moderately slow in subsoil, moderate in substratum; ditch banks subject to piping.	Available water capacity high in NbA, NbB, and moderate in NcA, NcB.	Seasonal water table moderately high.
Seasonal water table high, hazard of frost heave high.	Seasonal water table high.	Mixed materials sandy, moderately permeable, subject to piping.	Seasonal water table high, recharge rate rapid.	Water table seasonally high, permeability moderately slow in subsoil, moderate in substratum, ponding in places, ditch banks subject to piping.	Seasonal water table high, available water capacity high.	([2]).

TABLE 8.—*Engineering interpre*

Soils and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Sand and gravel	Road fill
Pemberton sand: PbA. Pemberton sand, thick surface: PcA.	Fair: seasonal water table moderately high.	Slight	Poor: low fertility, low available water capacity.	Good for sand; unsuitable for gravel.	Good: A–2 or A–4.
Pits, sand and gravel: Pt.	Good: material loose and rapidly permeable.	Slight	Unsuitable: low fertility, low available water capacity.	Poor: supply exhausted in most places.	Fair: A–1, A–2, or A–3 but good in A–3 if filler is added.
Pits, clay and marl: Pu.	Poor: plastic material.	Severe	Poor: plastic material.	Unsuitable for sand and gravel.	Poor: A–6 or A–7, highly plastic.
Pocomoke fine sandy loam: Pv.	Poor: seasonal water table high.	Severe: seasonal water table high.	Fair in top foot: seasonal water table high.	Fair for sand below depth of 2½ feet, seasonal water table high, poor for gravel.	Good: A–2 or A–4, seasonal water table high.
Sandy land, ironstone: Se.	Good	Slight	Poor: shallow to ironstone.	Unsuitable for sand and gravel.	Fair: ironstone may make material hard to obtain.
Sassafras loamy sand: SfB. Sassafras fine sandy loam: SgA, SgB, SgC. Sassafras-Urban land complex (where profile has not been destroyed): Sk. (For Urban land part in Sk, see Ug.)	Good	Slight for SfB; moderate for SgA, SgB, SgC, Sk.	Good for SgA, SgB, SgC, and Sk; fair for SfB.	Good for sand below depth of 30 inches; good for gravel in places.	Good: A–2 or A–4.
Sassafras fine sandy loam, clayey substratum: ShA, ShB. Sassafras-Urban land complex, clayey substrata (where profile has not been destroyed): Sm. (For Urban land part in Sm, see Uv.)	Fair: underlain by clayey material.	Moderate	Good	Unsuitable for sand and gravel.	Good: A–2 or A–4 to depth of 30 inches.
Shrewsbury fine sandy loam: Sn. Shrewsbury fine sandy loam, clayey substratum: So. Shrewsbury loam: Sp. Shrewsbury sandy clay loam, truncated: Sv.	Poor: seasonal water table high.	Severe	Fair: seasonal water table high.	Fair for sand below depth of 30 inches; unsuitable for gravel.	Fair: A–2 or A–4, seasonal water table high.
Shrewsbury fine sandy loam, ironstone variant: Sx.	Poor: seasonal water table high.	Severe	Poor: shallow to ironstone.	Poor for sand and gravel.	Poor: shallow to ironstone.
Tinton sand: TsB, TsC. Tinton sand, thick surface: TtB.	Good	Slight	Poor: low fertility, low available water capacity.	Good for sand; unsuitable for gravel.	Good
Urban land, sandy: Ug.	Good	Slight	Poor: limited supply.	([2])	Good: A–2 or A–4.
Urban land, clayey: Ut.	Poor: plastic material.	Severe	Poor: plastic material.	([2])	Poor: A–6 or A–7.

tations of the soils—continued

Soil features affecting—						
Road location	Reservoirs			Drainage	Irrigation	Grassed waterways
	Reservoir area	Embankment	Dugout			
Seasonal water table moderately high, loose sand hinders hauling.	Permeable material, seasonal water table moderately high.	Fair stability, permeable material.	Seasonal water table moderately high.	Permeability moderate to moderately rapid.	Available water capacity low, intake rate rapid.	Low fertility and available water capacity.
Ponding in some pits.	Variable soil material, but generally rapidly permeable unless water table is high.	Rapidly permeable.	Variable	(2)	(2)	(2).
Material plastic, frost-heave hazard high, ponding in places.	Seepage slow in clay pits, moderate in marl pits.	Subject to cracking.	Recharge rate slow.	(2)	(2)	(2).
Seasonal water table at surface; frost-heave hazard.	Seasonal water table high.	Sandy material, impervious when compacted.	Recharge rate rapid.	Seasonal water table at surface, permeability moderate in substratum, water ponded in places.	High available water capacity, seasonal water table high.	Seasonal water table at surface.
Steep slopes, ironstone layer.	(2)	Variable material.	(2)	(2)	(2)	Shallow soil material over ironstone.
(1)	Permeable substratum, seepage likely.	Good stability, impervious when compacted.	(2)	(2)	(1)	(1).
Underlain by clayey layers at depths below 30 inches.	(1)	Good stability, substratum material subject to cracking.	(2)	(2)	(1)	(1).
Seasonal water table high; frost-heave hazard.	Seasonal water table high.	Fair stability, impervious when compacted.	Seasonal water table high, recharge rate rapid except in So.	Permeability moderate.	High available water capacity.	(2).
Seasonal water table high; frost-heave hazard.	Seasonal water table high.	Shallow depth to ironstone.	Seasonal water table high, ironstone obstruction.	Permeability moderate, shallow rooting depth.	Shallow rooting depth.	(2).
Loose sand hinders hauling.	Rapidly permeable material.	Material rapidly permeable.	(2)	(2)	Low intake rate, low available water capacity.	Low fertility and available water capacity.
Well-drained sandy material.	Seepage likely	Material permeable.	(2)	(2)	Low available water capacity.	(2).
Plastic material; frost-heave hazard.	Little seepage	Subject to cracking.	(2)	(2)	High available water capacity.	Subject to severe frost heaving.

TABLE 8.—*Engineering interpre*

Soils and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Sand and gravel	Road fill
Urban land, sandy over clayey: Uv.	Good	Slight	Poor: limited supply.	([1])	Good in upper few feet.
Westphalia loamy fine sand: WaA, WaB. Westphalia fine sandy loam: WdA, WdB.	Good	Slight for WaA, WaB;; moderate for WdA, WdB.	Good for WdA, WdB, in top foot; fair for WaA, WaB.	Good for sand, uniformly fine below depth of 2½ feet; unsuitable for gravel.	Good: A–2, A–4, or A–3.
Woodmansie sand: WeB, WeC.	Good	Slight	Poor: very low fertility, very low available water capacity.	Good for medium and coarse sand below depth of 2½ feet; poor for gravel, beds thin.	Fair: A–2 and in A–3, good in A–3 if filler is added.
Woodmansie sand, firm substratum: WgB. Woodmansie sand, loamy substratum: WhB.	Good	Slight	Poor: very low fertility, very low available water capacity.	Fair for medium and coarse sand below depth of 2½ feet, interbedded with fines in WhB; fair for gravel in WgB, rounded quartzose gravel up to 2 inches in diameter.	Fair: A–2 and A–3, good in A–3 if filler is added.
Woodstown loamy sand: WkA. Woodstown fine sandy loam: WmA, WmB.	Fair: seasonal water table moderately high.	Moderate for WmA, WmB: seasonal water table supplies capillary moisture; slight for WkA.	Good for WmA, WmB, in top foot: seasonal water table moderately high; fair below 1 foot: low available water capacity, low fertility, fair for WkA.	Good for sand below depth of 2½ feet; poor for gravel below depth of 2½ feet, beds are thin and occurrence is unpredictable.	Fair: A–2 and A–3; good in A–3 if soil filler is added; seasonal water table moderately high.
Woodstown loamy sand, loamy substratum: WlA. Woodstown fine sandy loam, clayey substratum: WnA, WnB.	Fair: seasonal water table moderately high.	Moderate for WnA, WnB: seasonal water table supplies capillary moisture; slight for WlA.	Good for WnA, WnB, in top foot: seasonal water table moderately high; fair below 1 foot: low available water capacity, low fertility, fair for WlA.	Poor for sand	Fair: A–2 to depth of 40 inches, A–4, A–6, A–7 below; seasonal water table moderately high.

[1] All features generally are favorable.

tations of the soils—continued

Soil features affecting—						
Road location	Reservoirs			Drainage	Irrigation	Grassed waterways
	Reservoir area	Embankment	Dugout			
Surface material sandy.	Little seepage	Upper material sandy, substratum material plastic.	([2])	([2])	Low available water capacity in surface layer.	([1]).
Capillary action high in uniform fine sands; frost-heave hazard.	Seepage likely, substratum permeable.	Sandy material, but impervious when compacted.	Water table low, substratum permeable.	([2])	Available water capacity moderate in WaA, WaB; high in WdA, WdB.	([1]).
Loose sand hinders hauling operations.	Substratum rapidly permeable, water table low.	Sandy material, rapidly permeable, difficult to vegetate.	([2])	([2])	Very low fertility, very low available water capacity.	Very low fertility and available water capacity.
Loose sand hinders hauling operations.	Substratum moderately permeable or slowly permeable, water table low.	Permeable material.	([2])	([2])	Very low fertility, very low available water capacity.	Very low fertility and available water capacity.
Seasonal water table moderately high.	Substratum moderately permeable, seasonal water table moderately high.	Permeable material.	Seasonal water table moderately high, normal level below depth of 5 feet in summer.	Seasonal water table moderately high, permeability moderately slow or moderate in subsoil, moderate or moderately rapid in substratum.	Moderate available water capacity and intake rate.	Seasonal water table moderately high.
Seasonal water table moderately high.	Substratum moderately permeable for WlA, slowly permeable for WnA, WnB.	Permeable material to depth of 40 inches, loamy or clayey below.	Seasonal water table moderately high, normal level below depth of 5 feet in summer.	Subsoil permeable, seasonal water table moderately high.	Moderate available water capacity.	Seasonal water table moderately high.

[2] Not applicable or not needed.

cent counties, and on experience in working with individual kinds of soils in this county.

Marsh, fresh water (Ms), Marsh, tidal (Mt), and Muck, shallow (Mu) are not listed in table 7, because these land types are so variable that it is impractical to estimate most of their properties. The seasonal high water table of these land types is at the surface. Also not listed because they are so variable are Made land, dredged coarse material (Ma), Made land, dredged fine material (Mf), and Made land, sanitary fill (Mg). The depth to the seasonal high water table is more than 5 feet in Made land, dredged coarse material, and Made land, dredged fine material, and ranges from 3 to 5 feet or more in Made land, sanitary fill.

The depth to the seasonal high water table given in table 7 is the highest level that the water table or perched water table reaches when rainfall is normal. Depth from the surface indicates the thickness of horizons described as typical for the series, though in table 7 two or more horizons may be combined. Estimates in the succeeding columns are ranges for the horizons.

Depth to bedrock is not given in table 7, because all the soils in the county are more than 5 feet deep to bedrock.

The USDA texture is determined by the proportions of sand, silt, and clay particles, by weight, in soil material consisting of particles less than 2.0 millimeters in diameter. The terms "sand," "silt," and "clay" and some other terms used for textural classes are defined in the Glossary of this soil survey. The Unified and AASHO classification systems are explained under "Engineering Classification of Soils."

Percentage passing sieves is the percentage of the samples, by weight, that passes each sieve indicated. The samples do not include material more than 3 inches in diameter.

Permeability relates only to movement of water downward through wet soil that is not disturbed, not compacted, and not frozen. It does not include lateral seepage. Estimates are based on tests made by Rutgers University Soils Laboratory on cores of similar soils. Where no test data were available, the estimates are based on structure and porosity of the soil. Not considered are plowpans, surface crusting, compaction, and other properties resulting from use of the soils.

The available water capacity of a soil is the amount of capillary water that is available to plants after all free water has drained away. Estimates are based on information published in Bulletin 815 published by the New Jersey Agricultural Experiment Station (*13*).

The column, Optimum moisture for compaction, is for that part of the sample passing the No. 4 sieve. It is the moisture content that gives the maximum dry density for a specific method of compaction. Maximum dry density is the highest dry unit weight of a soil that has been compacted when moisture content is optimum. Shrink-swell potential indicates the change in volume of soil material that is expected as the moisture content changes.

Reaction, or acidity or alkalinity, is not given in table 7, because reaction is fairly uniform for most soils in this county. The surface layer of nearly all soils is naturally extremely acid. The subsoil and substratum are naturally very strongly acid in most places. Where they are heavily limed, many soils are almost neutral to a depth of 30 or 40 inches. In some places the highly glauconitic Marlton, Kresson, and Colemantown soils are not so acid in the substratum as are most other soils in the county. In these soils ponded ground water is neutral in places. Other exceptions are the Freehold and Holmdel soils near Vincentown, where they formed on limy sand and have a substratum that is nearly neutral or is alkaline. Alluvial land, loamy, in the Vincentown and Cookstown areas, also is influenced enough by the limy sand to make it nearly neutral in places.

Engineering interpretations of soils

Table 8 contains information helpful to engineers and others who plan to use soil material in constructing highways and various facilities.

Suitability for winter grading indicates the ease or difficulty that soil materials can be moved, mixed, or compacted when subject to freezing and thawing. Susceptibility to frost action indicates the relative degree of movement that normally occurs in the undisturbed surface layer at freezing temperatures.

Suitability as a source of topsoil is based on ability of the soil to grow vegetation. Soil features, such as high water table, are listed but were not considered in the rating. Among the features considered were fertility, available water capacity, and organic-matter content. Suitability as a source of sand and gravel is based on the general use of these materials in construction. Information on special and industrial uses of sand can be obtained from "Industrial Sands of New Jersey" (*12*). Suitability for road fill is based on use of the removed material as a subgrade, which supports the subbase and base coarse or surface coarse, as well as highway loads.

In choosing locations for roads, features are considered that indicate how undisturbed soil will serve as a subgrade for a road. It is assumed, however, that highly organic material will be removed. Both the soil material and natural drainage are considered.

Soil features that affect reservoir areas are those relating to suitability of the undisturbed soil for holding water. The substratum is mentioned separately where it varies markedly from the material above it. Stability, permeability, and seepage affect use of soil as embankment material. Dug ponds are affected by features that influence recharging the pond with ground water.

Drainage is affected by soil features that influence the installation and performance of both surface and subsurface drains (fig. 25, *top*). Outlets are assumed to be available, but they may be expensive to obtain (fig. 25, *bottom*). A high water table, infiltration, the hazard of ponding, and other features affect use of soils for irrigation. Grassed waterways are affected by fertility, available water capacity, and hazards of water erosion and soil blowing.

Soils formed in glauconitic material

Some of the soils of Burlington County were derived from material containing glauconite. Where the glau-

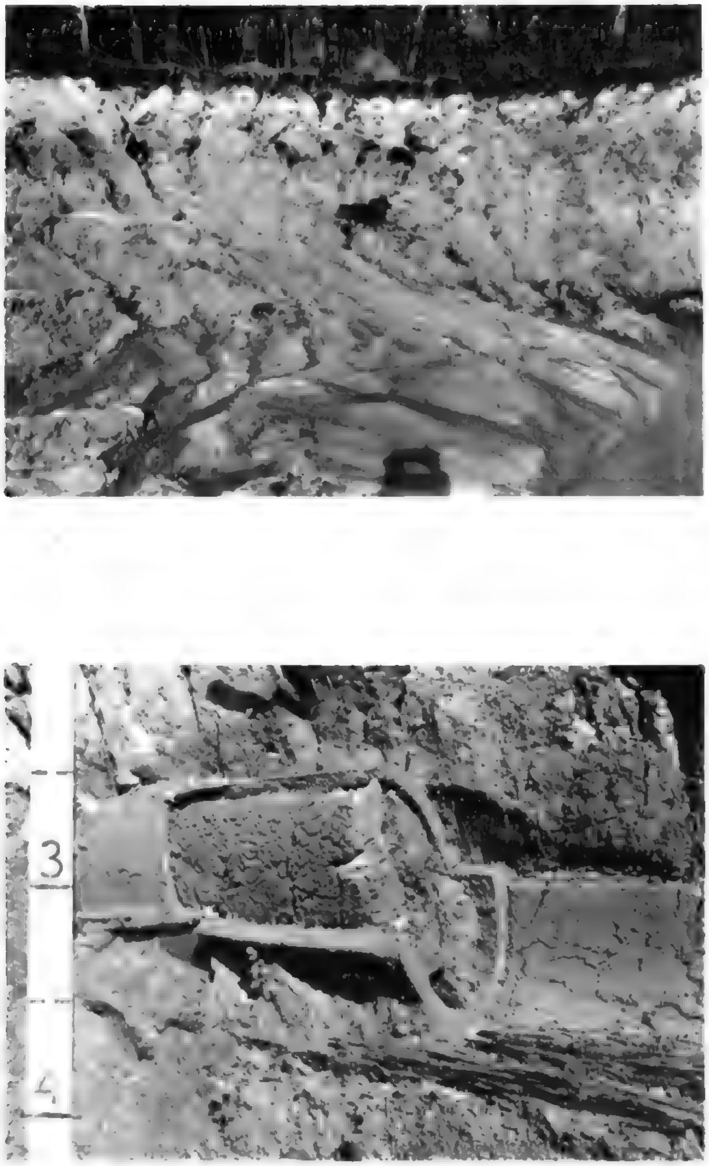

Figure 25.—Top, **some fine wet sands flow readily when drained;** ***bottom,*** **maintenance of outlet ditches is needed to keep underdrains free.**

conite is less than 10 percent of the soil mass, it has little effect on the behavior of the soil. Marlton, Kresson, Colemantown, and other soils in the county are more than 40 percent glauconite. Where this material is weathered, it behaves like a clay, and sieve analysis or hydrometer analysis indicates that it is clay or sandy clay. Below the weathered zone, at a depth of about 30 to 36 inches, the material is aggregated and is granular and friable. Sieve analysis indicates that this material is mostly sand size. Unless special care is taken, hydrometer tests also indicate the material to be sand size. With continued agitation, however, the material breaks down to silt and clay size and it has properties of both sand and clay (*21*). Available water capacity is high, and permeability is low, much lower than the apparent texture suggests. The shrink-swell ratio is greater than expected. Since a variation in testing methods and results is possible, the test data and soil properties for the substratum of glauconitic soils given in tables 6 and 7 may not be reliable.

Soils in Community Development

This section was prepared for planners, developers, zoning officials, landowners, and prospective landowners. The information in the section is in table 9.

In table 9, the soil features affecting use of the soils for foundations of low buildings are listed and limitations of the soils for selected uses in community development are rated. The ratings are slight, moderate, and severe. *Slight* means that the soil has few or no limitations other than those that can be overcome through normal planning and design. *Moderate* limitations require special attention. *Severe* limitations for any of the uses cannot be corrected at reasonable cost, or correction is otherwise impractical. If the rating is moderate or severe, the main soil feature or features that cause this limitation are given. Present use of the soils is not considered in making the ratings.

Readers who want to know more about the soils or their use for farming should refer to the section "Descriptions of the Soils". Information of interest to engineers and community planners is in the section "Engineering Applications" and in "Soil Surveys and Land Use Planning" (*20*). Following are explanations of the uses rated in table 9.

TABLE 9.—*Properties and limitations of*

Soil type and map symbol	Soil features affecting foundations for low buildings		
		Disposal of septic effluent	Landscape plants and lawns
Adelphia fine sandy loam: AaA, AaB. Adelphia loam: AhA. Adelphia sandy clay loam, truncated: Ak.	Seasonal water table moderately high; subsoil sandy clay loam, substratum loamy sand.	Moderate: seasonal water table moderately high; needs drainage.	Moderate: seasonal water table moderately high.
Adelphia fine sandy loam, clayey substratum: AcA, AcB. Adelphia fine sandy loam, glauconitic variant: AnA, AnB.	Seasonal water table moderately high; subsoil and substratum sandy clay loam or finer.[1]	Severe: seasonal water table moderately high; slowly permeable substratum.	Moderate: seasonal water table moderately high.
Alluvial land, loamy: Ao.	Subject to stream overflow; seasonal water table high.	Severe: subject to stream overflow; water table moderately high to high.	Severe: water table moderately high to high.
Alluvial land, sandy: Ap.	Subject to stream overflow; seasonal water table high.	Severe: subject to stream overflow; seasonal water table high and does not drop much in summer.	Severe: subject to stream overflow; seasonal water table high; low fertility.
Atsion sand: At. Atsion sand, loamy substratum: Au. Atsion fine sand: Av. Atsion fine sand, loamy substratum: Aw. Berryland sand: Bp. Berryland fine sand: Bt. Berryland mucky sand: Bu.	Seasonal water table high; good shear strength.	Severe: seasonal water table high.	Severe: low fertility; seasonal water table high.
Colemantown loam: Cm.	Seasonal water level high; shear strength fair in subsoil, good to poor in substratum.	Severe: seasonal water level high; slow permeability.	Severe: seasonal water level high.
Collington fine sandy loam: CnA, CnB. Collington loam: CoA, CoB.	Shear strength good to fair in subsoil, good in substratum.	Slight	Slight
Collington fine sandy loam, 5 to 10 percent slopes: CnC.	Shear strength good to fair in subsoil, good in substratum.	Moderate: strong slopes	Moderate: erosion hazard; runoff rapid.
Donlonton fine sandy loam: DeB. Donlonton loam: DlA.	Seasonal water level moderately high; shear strength fair.	Severe: seasonal water level moderately high; slow permeability.	Moderate: surface ponding; seasonal water level moderately high.
Downer loamy sand: DoA, DoB. Downer loamy sand, gravelly substratum: DpB. Downer loamy sand, loamy substratum: DrA. Downer loamy sand, truncated: DsB.	Shear strength good	Slight: careful design and installation may be needed for DrA.[3]	Moderate: low fertility; low available water capacity; soil blowing hazard.
Downer loamy sand, 5 to 10 percent slopes: DoC.	Shear strength good	Moderate: Strong slopes [3]	Moderate: low fertility; low available water capacity; water erosion hazard; runoff high.
Evesboro sand: EvB, EvC. Evesboro sand, loamy substratum: EwB. Evesboro fine sand: EyB.	Shear strength good	Slight for EvB, EwB, EyB;[3] moderate for EvC; strong slopes.	Severe: very low available water capacity; low fertility; erosion hazard on EvC.
Fallsington fine sandy loam: Fa. Fallsington fine sandy loam, clayey substratum: Fc.	Seasonal water table high; shear strength good.	Severe: seasonal water table high; Fc has slowly permeable substratum.	Severe: seasonal water table high.
Freehold fine sandy loam: FfA, FfB.	Shear strength good to fair in subsoil, good in substratum.	Slight	Slight

soils used for community development

Limitations of soil for—

Streets and parking lots	Athletic fields	Parks and playgrounds	Sanitary land fills
Severe: seasonable water table moderately high; high frost-action potential.	Moderate: seasonal water table moderately high.	Slight	Severe: seasonal water table moderately high.
Severe: seasonal water table moderately high; slowly permeable substratum; high frost-action potential.	Moderate: seasonal water table moderately high.	Slight	Severe: seasonal water table moderately high.
Severe: water table moderately high to high, under pressure in many places; subject to stream overflow.	Severe: water table moderately high to high, under pressure in many places; subject to stream overflow.	Moderate: subject to stream overflow.	Severe: Water table moderately high to high, under pressure in most places; subject to flooding.
Severe: subject to stream overflow; seasonal water table high.	Severe: subject to stream overflow; seasonal water table high.	Moderate: subject to stream overflow; seasonal water table high.	Severe: subject to stream overflow; seasonal water table.
Severe: seasonal water table high.	Severe: seasonal water table high; loose sand texture.	Moderate: seasonal water table high.	Severe: seasonal water table high.
Severe: seasonal water level high; highly plastic subsoil; frost-action potential high.	Severe: seasonal water level high; highly plastic subsoil; subject to surface ponding.	Moderate: seasonal water level high; subject to surface ponding.	Severe: seasonal water level high; highly plastic subsoil.
Slight	Slight	Slight	Slight.[2]
Moderate: frost-action potential; strong slopes.	Severe: strong slopes	Slight	Slight.[2]
Moderate: seasonal water level moderately high; highly plastic subsoil; frost-action potential high.	Moderate: seasonal water level moderately high; subsoil slowly permeable; hazard of surface ponding.	Moderate: seasonal water level moderately high; subsoil highly plastic.	Severe: seasonal water level moderately high; highly plastic subsoil.
Slight	Moderate: low fertility; low available water capacity; loose consistence.	Moderate: loose sandy surface.	Severe: filter material limited.[2]
Slight for streets; moderate for parking lots; strong slopes.	Severe: strong slopes; low fertility; low available water capacity.	Moderate: loose sandy surface.	Severe: filter material limited.[2]
Slight for streets: EvC, moderate for parking lots; strong slopes.	Severe: very low available water capacity; low fertility; loose consistence.	Severe: loose sand	Severe: filter material limited.[2]
Severe: seasonal water table high; high frost-action potential.	Severe: seasonal water table high.	Severe: seasonal water table high.	Severe: seasonal water table high.
Moderate: frost-action potential.	Slight	Slight	Slight.[2]

TABLE 9.—*Properties and limitations of soils*

Soil type and map symbol	Soil features affecting foundations for low buildings	Disposal of septic effluent	Landscape plants and lawns
Freehold fine sandy loam, 5 to 10 percent slopes: FfC.	Shear strength good to fair in subsoil, good in substratum; strong slopes.	Moderate: strong slopes	Moderate: erosion hazard; runoff rapid.
Freehold fine sandy loam, 10 to 15 percent slopes: FfD. Freehold sandy loam, 10 to 15 percent slopes, severely eroded: FoD3.	Shear strength good to fair in subsoil, good in substratum; moderately steep slopes.	Severe: moderately steep slopes.	Moderate: severe erosion hazard; runoff very rapid.
Freehold fine sandy loam, 15 to 25 percent slopes: FfE.	Shear strength good to fair in subsoil, good in substratum; steep slopes.	Severe: steep slopes	Severe: severe erosion hazard.
Freehold fine sandy loam, clayey substratum: FgB.	Shear strength good in subsoil, good to fair in substratum.	Moderate: slowly permeable substratum.	Slight
Freehold loamy sand: FhB.	Shear strength good	Slight	Moderate: moderate available water capacity in surface layer.
Freehold loamy sand, 5 to 10 percent slopes: FhC. Freehold sandy loam, 5 to 10 percent slopes, severely eroded: FoC3.	Shear strength good	Moderate: strong slopes	Moderate: moderate available water capacity in surface layer; water erosion hazard; runoff rapid.
Galestown sand: GaA.	Shear strength good	Slight[3]	Moderate: low available water capacity; low fertility.
Galestown sand, clayey substratum: GcB.	Shear strength good in subsoil; good to fair in substratum.	Moderate: slowly permeable substratum.	Moderate: low available water capacity; low fertility.
Holmdel fine sandy loam: HdA, HdB. Holmdel-Urban land complex: Hn.	Seasonal water table moderately high; shear strength good in substratum.	Moderate: seasonal water table moderately high; needs drainage.	Moderate: seasonal water table moderately high.
Holmdel loamy sand: HlB.	Seasonal water table moderately high; shear strength good in substratum.	Moderate: seasonal water table moderately high; needs drainage.	Moderate: seasonal water table moderately high; low available water capacity in surface layer.
Holmdel fine sandy loam, clayey substratum: HmA, HmB.	Seasonal water table moderately high; shear strength good to fair in substratum.	Severe: seasonal water table moderately high; slowly permeable substratum.	Moderate: seasonal water table moderately high.
Keansburg fine sandy loam: Ka.	Seasonal water table high; shear strength good to fair in subsoil, good in substratum.	Severe: seasonal water table high.	Severe: seasonal water table high.
Keyport loamy sand: KeB. Keyport fine sandy loam: KfB. Keyport loam: KlA, KlB.	Seasonal water level moderately high; shear strength fair to poor.	Severe: slowly permeable substratum; excess water in substratum in places.	Slight: surface ponding on KlA.
Keyport loam, 5 to 10 percent slopes: KlC.	Seasonal water level moderately high; shear strength fair to poor.	Severe: slowly permeable substratum; excess water in substratum in places.	Moderate: water erosion hazard, runoff rapid.
Keyport loam, 10 to 15 percent slopes: KlD.	Seasonal water level moderately high; shear strength fair to poor; moderately steep slopes.	Severe: moderately steep slopes; slow permeability.	Moderate: water erosion hazard; runoff rapid.

used for community development—continued

Limitations of soil for—			
Streets and parking lots	Athletic fields	Parks and playgrounds	Sanitary land fills
Moderate: strong slopes, frost-action potential.	Severe: Strong slopes	Slight	Moderate: strong slopes.[2]
Severe: erosion hazard; moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.
Severe: steep slopes	Severe: steep slopes	Moderate for parks and severe for playgrounds: steep slopes.	Severe: steep slopes.
Moderate: frost-action potential, slowly permeable substratum.	Slight	Slight	Slight to moderate: plastic substratum.[2]
Slight	Moderate: loose sandy surface; moderate available water capacity in surface layer.	Slight	Slight.[2]
Slight for streets, moderate for parking lots: strong slopes.	Severe: strong slopes; moderate available water capacity in surface layer.	Slight: loose sandy surface layer.	Slight.[2]
Slight	Moderate: loose sandy surface layer; low available water capacity; low fertility.	Slight: loose sand surface layer.	Severe: filter material limited.[2]
Slight: slowly permeable substratum.	Moderate: loose sand at surface; low available water capacity; low fertility.	Slight	Slight.[2]
Severe: seasonal water table moderately high; frost-action potential.	Moderate: seasonal water table moderately high.	Slight	Severe: seasonal water table moderately high.
Moderate: seasonal water table moderately high.	Moderate: loose sand at surface; low available water capacity, low fertility in surface layer.	Slight	Severe: seasonal water table moderately high.
Severe: seasonal water table moderately high; high frost-action potential.	Moderate: seasonal water table moderately high.	Slight	Severe: seasonal water table moderately high.
Severe: seasonal water table high; high frost-action potential.	Severe: seasonal water table high.	Severe: seasonal water table high.	Severe: seasonal water table high.
Severe: underlying soil highly plastic; seasonal water level moderately high; high frost-action potential.	Moderate: permeability slow; hazard of surface ponding on KlA.	Slight	Severe: plastic subsurface layer.
Severe: subsoil highly plastic; erosion hazard; strong slopes; high frost-action potential.	Severe: strong slopes	Slight	Severe: strong slopes; plastic substratum.
Severe: subsoil highly plastic; moderately steep slopes; high frost-action potential.	Severe: moderately steep slopes.	Moderate: moderately steep slopes.	Severe: moderately steep slopes; plastic substratum.

TABLE 9.—*Properties and limitations of soils*

Soil type and map symbol	Soil features affecting foundations for low buildings	Disposal of septic effluent	Landscape plants and lawns
Keyport loam, 15 to 25 percent slopes: KlE.	Seasonal water level moderately high; shear strength fair to poor; steep slopes.	Severe: steep slopes; slow permeability.	Severe: steep slopes ------
Klej sand: KmA. Klej sand, loamy substratum: KnA. Klej fine sand: KoA.	Seasonal water table moderately high; shear strength good.	Moderate:[3] seasonal water table moderately high; needs drainage.	Moderate: seasonal water table moderately high.
Kresson loamy sand: KwA. Kresson fine sandy loam: KxA. Kresson loam: KyA.	Seasonal water level moderately high; shear strength fair to poor in subsoil, fair in substratum.[1]	Severe: seasonal water level moderately high; slowly permeable substratum.	Moderate: seasonal water level moderately high; hazard of surface ponding.
Lakehurst sand: LaA. Lakehurst sand, thick surface: LlA. Lakehurst sand, loamy substratum: LmA. Lakehurst fine sand: LnA. Lakehurst fine sand, loamy substratum: LoA. Lakehurst-Lakewood sands (Lakehurst part): LrA. Lakehurst-Lakewood sand, loamy substratum (Lakehurst part): LsA.	Seasonal water table moderately high; shear strength fair to good.	Moderate:[3] seasonal water table moderately high; careful location and installation may be needed in LmA, LoA; needs drainage.	Severe: very low fertility; very low available water capacity.
Lakewood sand: LtB, LtC, LtD. Lakewood sand, thick surface: LuB. Lakewood sand, loamy substratum: LvB. Lakewood fine sand: LwB. Lakewood fine sand, loamy substratum: LyA. Lakewood part of LrA and LsA.	Shear strength fair to good --	Slight[3] for all except LtC and LtD; moderate for LtC:[3] strong slopes; severe for LtD:[3] moderately steep slopes.	Severe: very low fertility, very low available water capacity.
Made land, dredged coarse material: Ma.	Shear strength good --------	Slight[3] --- -------------	Severe: low fertility; low available water capacity.
Made land, dredged fine material: Mf.	Shear strength fair to poor; slow permeability.	Severe: slow permeability --	Severe: highly plastic; slowly permeable.
Made land, sanitary fill: Mg.	Unstable material; uneven settling; gas formation from decomposition.	Severe: obstruction in fill material.	Severe: uneven settling ---
Marlton fine sandy loam: MhA, MhB. Marlton soils: MrC.	Seasonal water level moderately high to low.[1]	Severe: slowly permeable substratum; slopes strong for MrC.	Moderate: soil has short optimum working period.
Marsh, fresh water: Ms.	Surface ponding most of year.	Severe: flooded most of year.	Severe: flooded most of year.
Marsh, tidal: Mt.	Unstable material; flooded daily by tidal waters; water table high; subject to severe compaction and subsidence.	Severe: daily flooding by tidal waters; water table high, fluctuates little.	Severe: flooded daily by tidal waters; water table high, fluctuates little.
Muck, shallow: Mu.	Unstable material; seasonal water table high.	Severe: seasonal water table high, does not drop much in summer.	Severe: seasonal water table high.
Nixonton fine sandy loam: NbA, NbB. Nixonton loamy fine sand: NcA, NcB.	Seasonal water level moderately high; shear strength good to fair; substratum subject to piping.	Moderate: seasonal water table moderately high; needs drainage.	Moderate: seasonal water table moderately high.
Pasquotank fine sandy loam: Pa.	Seasonal water table high; soil subject to piping.	Severe: seasonal water table high.	Severe: seasonal water table high, hazard of surface ponding.

used for community development—continued

Limitations of soil for— Streets and parking lots	Athletic fields	Parks and playgrounds	Sanitary land fills
Severe: subsoil highly plastic; steep slopes; high frost-action potential.	Severe: steep slopes	Moderate: steep slopes	Severe: steep slopes.
Moderate: seasonal water table moderately high.	Moderate: seasonal water table moderately high.	Slight	Severe: seasonal water table moderately high.
Severe: seasonal water level moderately high; subsoil highly plastic; slowly permeable; high frost-action potential.	Moderate: seasonal water level moderately high; slowly permeable; hazard of surface ponding.	Moderate: loose sandy soil for KwA; seasonal water level moderately high.	Severe: seasonal water level moderately high.
Moderate: seasonal water table moderately high; loose sand.	Severe: very low fertility; very low available water capacity.	Moderate: loose sandy soil	Severe: seasonal water table moderately high.
Slight, except for LtC: strong slopes; severe for LtD: moderately steep slopes.	Severe: very low fertility; very low available water capacity.	Moderate: loose sand	Severe: filter material limited.[3]
Slight	Severe: loose sandy surface.	Moderate: loose sandy surface.	Severe: filter material limited.[3]
Moderate: highly plastic; slowly permeable; severe frost action.	Severe: highly plastic; slowly permeable material.	Moderate: highly plastic; slowly permeable.	Severe: highly plastic, slowly permeable material.
Severe: uneven settling	Severe: uneven settling; material variable but mostly coarse textured.	Slight	Severe: obstruction from fill material.
Severe: permeability slow; subsoil highly plastic; runoff rapid; high frost-action potential.	Moderate: permeability slow; soil sticky when wet; severe for MrC: strong slopes.	Slight	Moderate for MhA, MhB: subsoil sticky and plastic when wet; severe for MrC: strong slopes.
Severe: flooded most of year.	Severe: flooded most of year.	Severe: flooded most of year.	Severe: flooded most of year.
Severe: unstable material subject to severe compaction and subsidence.	Severe: flooded daily by tidal waters; water table high, fluctuates little.	Moderate: flooded daily by tidal waters; water table high, fluctuates little.	Severe: flooded daily by tidal waters; water table high, fluctuates little.
Severe: seasonal water table high; severe subsidence.	Severe: seasonal water table high.	Severe: seasonal water table high.	Severe: seasonal water table high.
Severe: seasonal water table moderately high; high frost-action potential.	Moderate: seasonal water table moderately high.	Slight	Severe: seasonal water table moderately high.
Severe: seasonal water table high; high frost-action potential.	Severe: seasonal water table high.	Severe for playgrounds; moderate for parks: seasonal water table high.	Severe: seasonal water table high.

TABLE 9.—*Properties and limitations of soils*

Soil type and map symbol	Soil features affecting foundations for low buildings	Disposal of septic effluent	Landscape plants and lawns
Pemberton sand: PbA. Pemberton sand, thick surface: PcA.	Seasonal water table moderately high; subsoil sandy clay loam, substratum loamy sand.	Moderate: seasonal water table moderately high; needs drainage.	Moderate: seasonal water table moderately high.
Pits, sand and gravel: Pt.	Shear strength good	Slight: seasonal water table may be high in some areas.	Severe: low fertility; low available water capacity.
Pits, clay and marl: Pu.	Water level variable; shear strength fair to poor.	Severe: slow permeability	Severe: slow permeability; highly plastic material.
Pocomoke fine sandy loam: Pv.	Seasonal water table high; soil subject to piping.	Severe: seasonal water table high.	Severe: seasonal water table high; hazard of surface ponding.
Sandy land, ironstone: Se.	Discontinuous ironstone layers at depth of about 2 feet; some slopes moderately steep.	Severe: stone obstruction; some slopes moderately steep and steep.	Severe: thin sandy soil over ironstone; very low available water capacity; low fertility.
Sassafras loamy sand: SfB.	Shear strength good	Slight	Moderate: moderate available water capacity in surface layer.
Sassafras fine sandy loam: SgA, SgB. Sassafras-Urban land complex: Sk.	Shear strength good to fair in subsoil, good in substratum.	Slight	Slight
Sassafras fine sandy loam, 5 to 10 percent slopes: SgC.	Shear strength good to fair in subsoil, good in substratum; strong slopes.	Moderate: strong slopes	Moderate: erosion hazard high; runoff rapid.
Sassafras fine sandy loam, clayey substratum: ShA, ShB. Sassafras-Urban land complex, clayey substrata: Sm.	Shear strength good in subsoil, good to fair in substratum.	Severe: slowly permeable substratum.	Slight
Shrewsbury fine sandy loam: Sn. Shrewsbury fine sandy loam, clayey substratum: So. Shrewsbury loam: Sp. Shrewsbury sandy clay loam, truncated: Sv. Shrewsbury fine sandy loam, ironstone variant: Sx.	Seasonal water table high; substratum shear strength good to fair.	Severe: seasonal water table high.	Severe: seasonal water table high.
Tinton sand: TsB, TsC. Tinton sand, thick surface: TtB.	Shear strength good	Slight for TsB and TtB, moderate for TsC: strong slopes.	Severe: very low fertility; very low available water capacity.
Urban land, sandy: Ug.	Shear strength good	Slight	Severe: low fertility; low available water capacity.
Urban land, clayey: Ut.	Shear strength fair to poor; slow permeability.	Severe: slow permeability	Severe: highly plastic, slowly permeable material.
Urban land, sandy over clayey: Uv.	Shear strength good at surface, good to fair below.	Severe: slow permeability	Severe: low fertility; low available moisture capacity.
Westphalia loamy fine sand: WaA, WaB. Westphalia fine sandy loam: WdA, WdB.	Shear strength good to fair.	Slight	Slight for WdA, WdB; moderate for WaA, WaB because of low available water capacity.

used for community development—continued

Limitations of soil for—			
Streets and parking lots	Athletic fields	Parks and playgrounds	Sanitary land fills
Moderate: seasonal water table moderately high.	Moderate: seasonal water table moderately high.	Slight	Severe: seasonal water table moderately high.
Slight	Severe: loose sand at surface.	Moderate: loose sand at surface.	Severe: filter material limited.[3]
Severe: flooding likely; highly plastic material.	Severe: slowly permeable; highly plastic material.	Severe: slowly permeable; highly plastic material.	Severe: slowly permeable; highly plastic material.
Severe: seasonal water table high; high frost-action potential.	Severe: seasonal water table high.	Severe for playgrounds, moderate for parks: seasonal water table high.	Severe: seasonal water table high.
Moderate to severe: some steep slopes; ironstone obstruction.	Severe: some steep slopes; ironstone obstruction; very low available water capacity.	Moderate: some steep slopes:	Severe: ironstone obstruction.
Slight	Moderate: loose sandy surface; moderate available water capacity in surface layer.	Slight	Slight: filter material may be limited.[3]
Moderate: frost-action potential.	Slight	Slight	Slight: filter material may be limited.[3]
Moderate: strong slopes; erosion hazard; frost-action potential.	Severe: strong slopes	Slight	Moderate: strong slopes; filter material may be limited.[3]
Moderate: frost-action potential.	Slight	Slight	Slight to moderate: plastic substratum.[3]
Severe: seasonal water table high; high frost-action potential.	Severe: seasonal water table high.	Severe for playgrounds: moderate for parks: seasonal water table high.	Severe: seasonal water table high.
Slight for TsB, TtB; moderate for TsC: strong slopes; loose sand; water erosion hazard.	Severe: loose sand	Severe: loose sand	Severe: filter material limited.[3]
Slight	Severe: loose sand at surface.	Moderate: loose sand at surface.	Severe: filter material limited.
Severe: highly plastic, slowly permeable material; high frost-action potential.	Severe: highly plastic; slowly permeable.	Moderate: highly plastic; slowly permeable.	Severe: highly plastic; slowly permeable.
Slight	Moderate: slowly permeable underlying layer; variable surface textures.	Slight	Severe: plastic, slowly permeable underlying layer.
Slight for WaA, WaB, moderate for WdA, WdB: frost-action potential.	Slight for WdA, WdB; moderate for WaA, WaB: loose loamy sand surface layer has low available water capacity.	Slight	Slight: filter material may be limited.[3]

TABLE 9.—*Properties and limitations of soils*

Soil type and map symbol	Soil features affecting foundations for low buildings		
		Disposal of septic effluent	Landscape plants and lawns
Woodmansie sand: WeB, WeC. Woodmansie sand, firm substratum: WgB. Woodmansie sand, loamy substratum: WhB.	Shear strength good	Slight for WeB and WhB, moderate for WgB, WeC: careful design and installation may be needed because of variable firm substratum; strong slopes for WeC.	Moderate to severe: low fertility; low available water capacity; WeC subject to water erosion.
Woodstown loamy sand: WkA. Woodstown loamy sand; loamy substratum: WlA. Woodstown fine sandy loam: WmA, WmB.	Seasonal water table moderately high; shear strength of substratum good.	Moderate: seasonal water table moderately high; needs drainage.	Moderate: seasonal water table moderately high.
Woodstown fine sandy loam, clayey substratum: WnA, WnB.	Seasonal water table moderately high; shear strength good to fair in substratum.	Severe: seasonal water table moderately high; slowly permeable substratum.	Moderate: seasonal water table moderately high.

[1] This material contains large amounts of glauconite that occur in sand-sized granules that break down to clay size with continued crushing and agitation.

Foundations for low buildings.—These are foundations for residential and commercial buildings of three stories or less that have a basement and low-load industrial buildings that are not subject to vibration. Where there is no basement, the water table is less important than indicated in table 9. The soil features affecting building foundations are listed for undisturbed soil. Where the substratum is different from the subsoil, features of both are listed. Factors considered in rating the soils are hazard of flooding, height of water table, stability, shear strength, and slopes. The disposal of septic tank effluent was not considered.

Disposal of septic effluent.—This disposal depends on soil permeability at a depth of 30 inches, depth to ground water, presence of ironstone, slope of the soil, and overflow hazard. Because slopes are strong, Freehold fine sandy loam has moderate limitations for use in disposal of septic effluent. This soil, however, can be used for sewage disposal because other features are favorable (fig. 26). It, like most soils in the county, has a stratified substratum that helps to filter the septic effluent and reduce pollution of the ground water. New Jersey law (*14*) requires a percolation test rate of at least 1 inch in 40 minutes and that the bottom of the disposal line be at least 4 feet above ground water.

The soil interpretations do not eliminate the need for onsite percolation tests. However, this information can assist the health authorities to determine for which general areas additional information is required on subsoil and ground water. Percolation tests made during dry seasons seldom indicate the seasonal ground water hazard. Also, dry season tests may not always reflect wet season rates, due to the difficulty of obtaining adequate presaturation.

A *slight* rating means that few or no limitations are caused by the percolation rate, ground water, overflow, and slope. Permitted under a rating of slight are a few deep excavations of trenches to a more permeable layer. These deep trenches, however, may cause a pollution hazard to shallow wells dug in rapidly permeable soils. *Moderate* limitations are those that can be overcome by special design and construction practices. Soils are rated *moderate* if they are moderately well drained and have a level of ground water that is moderately high (24 inches from surface) for part of the winter but that normally can be lowered by drainage. These soils must be drained deeply before home construction begins. Slopes of 5 to 10 percent require special design and construction of the lines. *Severe* limitations are caused by a percolation rate slower than 1 inch in 40 minutes, a high water table for more than half the year, an ironstone layer, slopes

Figure 26.—Installation of septic disposal lines on Freehold fine sandy loam.

used for community development—continued

Limitations of soil for—			
Streets and parking lots	Athletic fields	Parks and playgrounds	Sanitary land fills
Slight for WeB, WgB, WhB; moderate for WeC: strong slopes; water erosion hazard.	Severe: very low fertility; low available water capacity.	Moderate for parks; severe for playgrounds: loose sand at surface.	Slight: filter material may be limited.[3]
Severe: seasonal water table moderately high; frost-action potential high.	Moderate: seasonal water table moderately high.	Slight	Severe: seasonal water table moderately high.
Moderate for WkA, WlA: seasonal water table moderately high; severe for WmA, WmB: high frost-action potential.	Moderate: seasonal water table moderately high.	Slight	Severe: seasonal water table moderately high.

[2] Onsite investigations needed to determine conditions below 5 feet.
[3] Pollution hazard to shallow wells and streams.

of more than 10 percent, or susceptibility to stream overflow.

Landscape plants and lawns.—Factors considered in rating the soils are natural fertility, available water capacity, slope, natural drainage, and the hazard of stream overflow.

Streets and parking lots.—Ratings of soils are based on natural drainage or depth to water table, slope, hazard of stream overflow, permeability, and frost-action potential. It is assumed that slowly permeable soils and soils containing fluctuating levels of ground water will require abnormally thick, coarse-textured fill to eliminate frost heave.

Athletic fields.—The soils are rated according to slope, natural drainage, natural fertility, available water capacity, and the hazard of stream overflow. It is assumed that the area is to be intensively used and planted to grass. Additions of topsoil and fill are not considered in the rating.

Parks and playgrounds.—The soils in areas used intensively for parks and playgrounds are rated for slope, natural drainage, natural fertility, available water capacity, and texture of the surface soil. Limitations to use of soils for golf courses are similar to those for parks and playgrounds (fig. 27).

Figure 27.—Installing tile in Holmdel fine sandy loam next to a golf green so that excess water is removed and golf carts do not get stuck or damage the sod.

Limitations to use of soils in wet areas are reduced if, before construction of houses begins, deep ditches (fig. 28, *top*) are dug so that excavations for houses do not fill with water (fig. 28, *bottom*).

Sanitary land fills.—This refers to trench disposal of wastes that are regularly covered by soil. Soil factors used in rating are natural drainage or height of water table, soil texture, overflow hazard, presence of ironstone, and slope. Soils with *slight* limitations have no significant limitations to a depth of at least 5 feet. The seasonal high water table should not reach the bottom of the fill and, if practical, the base of the pit should be underlain by 6 to 8 feet of well-drained soil. Detailed onsite investigations are needed to determine that the soil material and depth to water table are satisfactory.

Formation and Classification of Soils

This section contains three main parts. The first part discusses factors of soil formation as they relate to the development of soils in Burlington County. The second part describes important processes in the devel-

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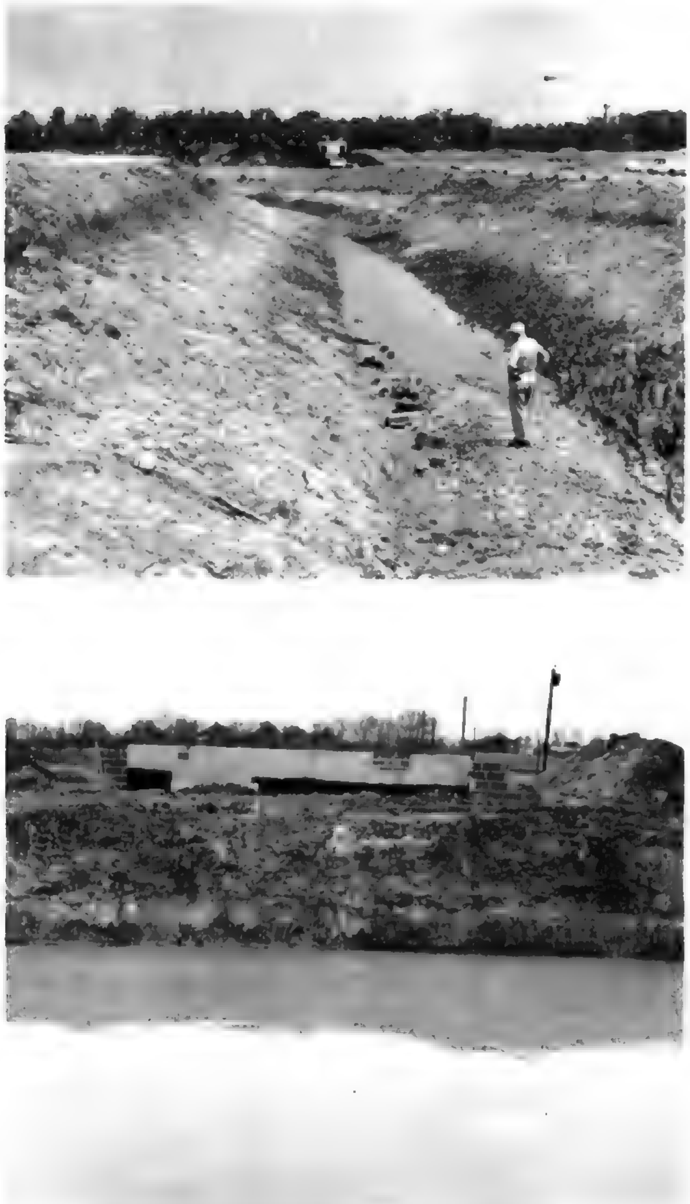

Figure 28.—Top, **deep ditch dug in Colemantown loam. The areas in the right background are being prepared for home construction.** ***Bottom,*** **excavations in Fallsington fine sandy loam for a basement. The site should have been drained before construction began.**

opment of soil horizons. The third part explains how the soils are classified according to the comprehensive system used by the National Cooperative Soil Survey.

Formation of Soils

Five important factors have influenced the formation of soils and soil characteristics in Burlington County. These factors are parent material, climate, relief, biological activity, and time. A discussion of each of these follows.

Parent material

Nearly all of the soils of Burlington County formed from unconsolidated geologic strata or from reworked unconsolidated material. Most of the older beds are considered marine deposits. The more recent deposits are believed to be of the Pleistocene (Ice) age (*7*). Although the glaciers did not reach so far south as Burlington County, melt water from the glaciers probably covered nearly all of the county and mixed the materials of the older marine deposits. Rounded quartzose gravel believed to be of Pleistocene age, can be found in all parts of the county, including the highest elevations, or those of more than 200 feet. In extensive areas this gravel is not abundant, but it is present in small amounts.

During the Pleistocene age the climate of the county was much colder than it is now, and the sea level fluctuated greatly. This fluctuation probably caused the formation of lakes that do not exist now. When the water level was low, much erosion by wind and water reworked the original soil deposits. Except for this mixing, the soils of the county are closely related to the parent material from which they formed. Marlton, Kresson, and Colemantown soils generally formed on geologic deposits that contain large amounts of glauconite. Keyport and Donlonton soils formed on the Woodbury and Merchantville clay. Freehold, Collington, Holmdel, and Adelphia soils formed on sandy marine deposits containing glauconite. Westphalia, Nixonton, and Pasquotank soils formed on the fine sands of the Kirkwood Formation. Lakewood, Lakehurst, and Woodmansie soils formed from Cohansey deposits. Table 10 shows the texture of the subsoil, natural drainage, and other characteristics of the soil series in the county.

Climate and relief

Climate and relief are so interrelated that they are discussed together. The climatic changes during and after the ice age had considerable effect on the soils of Burlington County. Melt waters were responsible for much erosion and mixing of soil materials. High winds during this period were probably responsible for the sand deposits on the south side of Rancocas Creek.

During the time that soils were forming, large amounts of water covered the low areas of the county. In the soils of these areas, accumulation of organic matter is apparent in the dark surface horizon. Also, the gray colors in the subsoil indicate that the iron oxides could not form in the flooded areas. The soils that formed high in the landscape generally were well drained. Iron oxides formed freely in these soils. Slopes in the county generally are not steep enough to prevent soil horizons from forming. Although the steep soils are thinner, clearly defined horizons are present nearly everywhere.

Biological activity

Two different kinds of soils were formed in Burlington County from the fine sand parent material of the Kirkwood Formation. In North Hanover Township, where a hardwood vegetation was over this formation, the Westphalia, Nixonton, and Pasquotank soils devel-

TABLE 10.—*Soil series arranged according to texture of the subsoil and natural drainage*

Texture of the subsoil [1] and other soil characteristics	Excessively drained: Uniform colors, dominantly yellow to brown, within a horizon to a depth of 30 inches; sandy texture	Well drained: Uniform colors of brown to olive within a horizon to a depth of 30 inches; sandy loam or more clayey B horizon	Moderately well drained: Uniform colors within a horizon to a depth of 20 inches; mottled colors between depths of 20 and 30 inches	Somewhat poorly drained: Dark grayish-brown surface layer; mottled colors of distinctly paler or olive colors between depths of 10 and 20 inches	Poorly drained: Dark-gray surface layer; light-gray or olive subsoil, with or without mottling	Very poorly drained: Nearly black surface layer; light-gray or olive subsoil, with or without mottling
Sand or loamy sand subsoil:						
Nonglauconitic material—						
Surface layer bleached to depth of 7 inches.	Lakewood	----------	Lakehurst	Lakehurst	Atsion	Berryland.
Surface layer bleached to depth of less than 7 inches.	Evesboro, Galestown	----------	Klej	Klej	----------	----------
Sandy loam to sandy clay loam subsoil:						
Nonglauconitic material—						
Surface layer bleached to depth of 7 inches.	----------	Woodmansie	----------	----------	----------	----------
Surface layer bleached to depth of less than 7 inches—						
Sand, medium to coarse.	----------	Downer, Sassafras	Woodstown	----------	Fallsington	Pocomoke.
Sand, uniformly fine or very fine.	----------	Westphalia	Nixonton	----------	Pasquotank	----------
Glauconitic material— Moderate content	----------	Collington	Adelphia	Adelphia	Shrewsbury	Keansburg.
Low content where surface layer is thick.	----------	Tinton	Pemberton	Pemberton	----------	----------
Low content where surface layer is normal.	----------	Freehold	Holmdel	Holmdel	Shrewsbury	Keansburg.
Clay loam subsoil: Glauconitic material, low content.	----------	----------	Keyport [2]	Donlonton	----------	----------
Sandy clay subsoil: Glauconitic material, high content.	----------	Marlton	Marlton	Kresson	Colemantown	----------

[1] Textures of subsoil listed in order of increasing clay content. [2] Variation from normal because of glauconitic content.

oped. In Evesham and Medford Townships, from near Kresson to Medford Lakes, the vegetation is mostly pines and the soils that formed are in the Lakewood, Lakehurst, Atsion, and Berryland series.

The bleaching of the surface layer in the Lakewood, Lakehurst, and Woodmansie soils was primarily caused by the effects of the needles, branches, bark, and roots of pines. Pitch pine seems to induce bleaching more than Virginia pine. The difference in bleaching may be partly because fires are more frequent in areas where pitch pine is more abundant than Virginia pine. It is possible that some soils in the county have been changed from Westphalia to Lakewood because wildfires converted the forest from hardwoods to pines. Pitch pine is more likely than hardwoods to resist fires.

Time

Except for soils formed over limy sand, most soils in the county are old enough to have been so thoroughly leached of the more soluble bases that they are either extremely acid or very strongly acid.

Considerably more time is required for the fine clay particles to move from the surface layer to the subsoil than is required for leaching. The subsoil in Galestown soils, which are among the youngest soils in Burlington County, is very weakly developed, and it contains only 3 to 5 percent more clay than the surface layer. The Sassafras soils that developed on the next older river terrace have 10 to 15 percent more clay in the subsoil than in the surface layer. The clay content of the subsoil is also related to the clay content of the parent material. The subsoil of the Keyport soils has a high content of clay because these soils formed from parent material containing large amounts of clay. But movement of clay is also indicated in Keyport soils, for the surface layer contains much less clay than the underlying layers.

Although the oldest geologic deposits in the county date back as much as 150 million years, the age of the soils formed on them is much less. Melt waters from the glaciers covered all of these old geologic deposits, and, except on the steepest slopes, spread mixed sandy material on them.

Development of Soil Horizons

In most places soil development begins by the weathering of rock or parent material to reduce it to smaller particles. In the Coastal Plain this process took place before the marine or melt-water deposits were laid down; consequently, chemical weathering and clay mineral formation are more important than the weathering of rock or parent material. Processes common to soils of the Coastal Plain are freezing and thawing, wetting and drying, heating and cooling, shrinking and swelling, and breaking particles into smaller sizes. These processes are responsible for soil structure development, especially the shrinking and swelling common to clayey soils (fig. 29).

In the Coastal Plain the processes of soil formation most responsible for developing horizons are (1) accumulation of organic matter, (2) leaching of carbonates and salts more soluble than calcium carbonates, (3) chemical weathering of the primary materials of the parent material into silicate clay minerals, (4) translocation of the silicate clay minerals and probably of some silt-size particles from one horizon to another, and (5) oxidation, reduction, hydrolysis, hydration and other chemical changes, and the transfer of iron. In most soils several or all of these processes are operating at the same time. A minimum of horizon differences occur in young alluvial soils and in very sandy soils.

The newly manmade soils dredged from the river have the least accumulation of organic matter in the surface layer. Sandy soils, such as the Evesboro, Klej, Lakewood, and Lakehurst, have accumulations of organic matter that are less than 1 percent. Freehold, Collington, and other finer textured, well-drained soils have 1 to 4 percent. The Pocomoke, Keansburg, and other very poorly drained soils have 5 to 10 percent accumulations of organic matter in the surface layer.

***Figure 29.*—Shrink-swell processes assist in the formation of the soil structure of Colemantown loam. Cracks in clayey soil greatly increase permeability.**

Except for the tidal marsh and soils formed over limy sand, leaching of carbonates has been so severe in all soils that they are naturally extremely acid or very strongly acid. Heavy liming of the farmed fields has changed these soils to a depth of 3 to 4 feet (*26*).

Results of chemical weathering are shown by the Marlton and Kresson soils that have silicate clay minerals strongly expressed in the sandy clay subsoil. These soils formed over friable and granular highly glauconitic deposits. Although the material in these deposits is mostly sand-sized, it has many of the properties of clay (*21*), such as high exchange capacity and high available water capacity.

Translocation of the clay minerals from one layer to another occurs in Collington and Sassafras soils. They have 10 to 15 percent more clay in the subsoil than in either the surface soil or the underlying layers.

Various chemical changes and iron transfer are common to many soils of Burlington County. The effects of oxidation and iron transfer are probably most striking in the Woodmansie soils, which have a strongly bleached gray surface layer and a yellowish-brown subsoil. In places where the subsoil is a finer texture than the surface soil, a Bh horizon develops that contains organic matter and possibly iron. In most places this Bh horizon does not occur in the Woodmansie soils.

Iron is transferred in the wet soils where iron is segregated in the mottles. Iron concretions commonly are in the Klej and Lakehurst soils, and iron slabs several inches thick form in Shrewsbury fine sandy loam, ironstone variant. Iron is reduced in soils that are wet for long periods. Most soils of this kind are gray because the iron is reduced instead of being oxidized. Examples are Fallsington and Pocomoke soils, which have a gray subsoil.

Classification of the Soils

Soils are classified so that we may more easily remember their characteristics. Classification enables us to assemble knowledge about soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to management and manipulation. First through classification, and then by use of soil maps, we can apply our knowledge of soils to specific tracts or parcels of land.

Soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodland; in developing communities; in engineering work; and in many other ways. Soils are

TABLE 11.—*Soil series classified according to current system of classification and the 1938 system with later revisions*

Series	Current system			1938 classification (with later revisions)
	Family	Subgroup	Order	Great soil group
Adelphia	Fine-loamy, mixed, mesic	Aquic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.
Atsion	Sandy, siliceous, mesic	Aeric Haplaquods	Spodosols	Ground water Podzols.
Berryland	Sandy, siliceous, mesic	Typic Haplaquods	Spodosols	Ground water Podzols.
Colemantown	Clayey, glauconitic, mesic	Typic Ochraquults	Ultisols	Low-Humic Gley soils.
Collington	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.
Donlonton	Clayey,[1] mixed, mesic	Aquic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.
Downer	Coarse-loamy, siliceous, mesic.	Typic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.
Evesboro	Mesic, coated	Typic Quartzipsamments	Entisols	Regosols.
Fallsington	Fine-loamy,[1] siliceous, mesic	Typic Ochraquults [2]	Ultisols	Low-Humic Gley soils.
Freehold	Fine-loamy,[1] mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.
Galestown	Sandy, siliceous, mesic	Psammentic Hapludults	Ultisols	Sols Bruns Acides.
Holmdel	Fine-loamy,[1] mixed, mesic	Aquic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.
Keansburg	Fine-loamy,[1] mixed, mesic	Typic Umbraquults	Ultisols	Humic Gley soils.
Keyport	Clayey,[3] mixed, mesic	Aquic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.
Klej	Mesic, coated	Aquic Quartzipsamments	Entisols	Regosols.
Kresson	Clayey, glauconitic, mesic	Aquic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Low-Humic Gley soils.
Lakehurst	Mesic, coated	Aquodic Quartzipsamments	Entisols [4]	Podzols.
Lakewood	Mesic, coated	Spodic Quartzipsamments	Entisols [4]	Podzols.
Marlton	Clayey, glauconitic, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.
Nixonton	Coarse-silty,[5] mixed, thermic.[3]	Typic Dystrochrepts [6]	Inceptisols	Gray-Brown Podzolic intergrading to Regosols.
Pasquotank	Coarse-silty,[5] mixed, acid, thermic.[3]	Typic Haplaquepts	Inceptisols	Low-Humic Gley soils.
Pemberton	Loamy, mixed, mesic	Arenic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.
Pocomoke	Coarse-loamy, siliceous, thermic.[3]	Typic Umbraquults	Ultisols	Humic Gley soils.
Sassafras	Fine-loamy,[1] siliceous, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.
Shrewsbury	Fine-loamy,[1] mixed, mesic	Typic Ochraquults	Ultisols	Low-Humic Gley soils.
Tinton	Loamy, mixed, mesic	Arenic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.
Westphalia	Coarse-loamy, siliceous, mesic.	Ochreptic Hapludults [7]	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.
Woodmansie	Coarse-loamy, siliceous, mesic.	Typic Hapludults	Ultisols	Podzols.
Woodstown	Fine-loamy,[1] siliceous, mesic	Aquic Hapludults	Ultisols	Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils.

[1] Clay content of the clay-enriched horizon locally low in places.

[2] Locally, either a low color value or a high chroma makes these soils aeric instead of typic.

[3] Soil temperatures a few degrees lower than 59° F. at depth of 20 inches, the normal limit.

[4] Lakehurst and Lakewood soils have a well-developed bleached horizon, but the horizon of organic matter and aluminum accumulation is so thin and discontinuous that pedon classifications are Entisols in as many places as they are Spodosols.

[5] Silt content locally low.

[6] Locally soils have clay-enriched horizons and qualify as Hapludults.

[7] Locally soils have clay-enriched horizons thicker than 10 inches and are typic Hapludults.

placed in broad classes to facilitate study and comparison in large areas, such as counties, States, and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*3*) and later revised (*22*). The system (*19, 25*) currently used was adapted for general use within the National Cooperative Soil Survey by the Soil Conservation Service in 1965. The current system is under continual study. Readers, therefore, interested in development of the current system should search the latest literature available.

Under the current classification system all soils are placed in six categories. Beginning with the broadest and most inclusive, the categories are order, suborder, great group, subgroup, family, and series. In table 11 each series of Burlington County is placed in the family, subgroup, and order of the current system and in the great soil group of the 1938 system. Because the current system is new and is still changing, the classification of the soils in table 11 is tentative.

ORDER: Although 10 orders are recognized in the broadest category of the new classification system, only 4 are represented in Burlington County. These are the Entisols, the Inceptisols, the Spodosols, and the Ultisols.

Entisols are mineral soils that have been modified only slightly from the geologic material in which they formed. In Burlington County the principal modification is a weakly developed A1 horizon. Evesboro and Klej soils are in this order. Lakewood soils are classified as Entisols in the subgroup Spodic Quartzipsamments, because they have a strongly bleached horizon but lack consistent spodic horizons.

Inceptisols (from the Latin *inceptum*, or beginning) are mineral soils in which horizons have started to develop. The Nixonton and Pasquotank series are in this order, though in Burlington County the soils in both series have a subsoil that qualifies as a clay enriched horizon.

Spodosols (from the Greek *spodos*, meaning wood ash) are soils that have, generally below the surface horizon, a horizon in which organic matter and aluminum, with or without iron, have accumulated. This material has high exchange capacity, large surface area, and high moisture retention. In Burlington County this horizon contains a large amount of free sesquioxides and organic carbon. The Atsion, and Berryland series are Spodosols.

Ultisols (from the Latin *ultimus*, or last) are strongly weathered or strongly developed soils that commonly represent advanced stages in soil formation. These are the most common soils in Burlington County. They range from well drained to very poorly drained.

SUBORDER: Each order is subdivided into suborders on the basis of genetic similarity. The suborders mainly reflect waterlogging or soil differences resulting from climate or vegetation. Suborders represented in the county are Udults, Aquults, Aquods, Psamments, Orthods, Ochrepts, and Aquepts. They are not shown separately in table 11, because they are the last part of the last word of the subgroup.

GREAT GROUP: Suborders are separated into great groups on the basis of uniformity in the kinds and sequences of major soil horizons and features of those horizons. The horizons used to make separations are those in which clay, iron, or humus has accumulated, or those that have pans interfering with growth of roots and movement of water. The features used are self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown in table 11, because it is the last word in the name of each subgroup.

SUBGROUP: Great groups are subdivided into subgroups, one of which represents the central (typic) segment of the group. The other subgroups, called intergrades, have properties of one group and also one or more properties of another great group, suborder, or order. The names of the subgroup are derived by placing one or more adjectives before the name of the great group (a Typic Hapludult).

The Typic Hapludults are well drained and moderately well drained soils. They include the Marlton soils, which intergrade to the Aquic subgroup. They also include Woodmansie soils, which generally have a strongly developed bleached horizon and a clay-enriched horizon but, in most places, lack an illuvial horizon in which large amounts of organic matter or alluvium have accumulated.

Galestown soils are in the Psammentic Hapludult subgroup. In Burlington County, however, a sandy surface layer more than 20 inches deep gives these soils some features of Arents.

General Information About the County

This section contains information about the climate, water supply, and the development of farming in Burlington County.

Climate[4]

Burlington County, though humid and temperate, has a continental climate. Except in the extreme southeastern corner, there is little influence from the ocean. Temperature and precipitation data for the county are given in table 12.

Summer temperatures seldom exceed 100° F., but they are frequently in the middle or upper 90's. Winter temperatures generally are not below 5° for long periods, but they are so low that drainage tile must be placed below a depth of 30 inches for protection against freezing. The ground normally is not frozen throughout the winter.

The average annual precipitation is about 44 inches, and the monthly averages in table 12 show that precipitation is well distributed throughout the year. Nearly every year, however, there are periods when rainfall is not enough for high-value crops. In recent years the irrigated acreage has increased, especially during the drought of 1961–1966. Rainfall is heaviest during July and August. Much of the rainfall in sum-

[4] By DONALD V. DUNLAP, State Climatologist, Environmental Science Services Administration, U.S. Department of Commerce.

TABLE 12.—*Temperature and precipitation*

[All data from 3 miles east of Pemberton, Burlington County]

Month	Temperature (°F.)				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with— Maximum temperature equal to or higher than—	Two years in 10 will have at least 4 days with— Minimum temperature equal to or lower than—	Average total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
					Inches	*Inches*	*Inches*	*Number*	*Inches*
January	43	25	60	6	3.3	1.6	5.5	6	5
February	44	25	61	7	2.9	1.6	4.6	5	6
March	52	31	70	18	3.8	1.9	5.5	2	4
April	64	40	81	25	3.5	1.6	5.5	0	0
May	76	50	88	33	3.5	1.0	6.4	0	0
June	83	59	94	45	3.6	1.7	6.4	0	0
July	87	64	96	52	4.5	1.7	8.2	0	0
August	85	62	93	48	4.9	1.7	8.6	0	0
September	79	55	91	40	3.9	1.0	8.7	0	0
October	69	45	82	30	3.1	1.3	5.8	0	0
November	57	36	72	22	3.5	1.4	6.0	([1])	1
December	45	26	62	9	3.1	1.4	5.6	3	4
Year	65	43	[2] 97	[3] −1	43.6	34.5	51.2	16	5

[1] Less than 0.5 day.
[2] Average annual highest maximum.
[3] Average annual lowest minimum.

mer comes as thunderstorms, of which there are about 28 annually. Occasionally rainfall is intense. It may reach a maximum of 2.0 inches in 1 hour, 5.0 inches in a 24-hour period, and from 9 to 13 inches in a month. Rainfall during winter frequently warms the soils enough to thaw them, but heavy rainfall on partly thawed soils is very erosive. Hail does not occur frequently, but at times it destroys high-value crops.

Records of the weather bureau stations at Trenton, Atlantic City, and Philadelphia show a large number of cloudy days each year. An average of 154 days are cloudy, 111 days are partly cloudy, and 100 days are clear. It rains or snows on about 117 days per year, and an average of 6 days per year have an inch or more of snowfall.

Winds affect crop production in the county. Most of the wind blows from the northwest. The critical period for soil blowing is from November to April. On the average, duration and velocity of the wind are greatest in March. By the end of March, cover crops have been plowed down in fields that are to be used for early crops. Sand blown by high winds cuts young corn and similar unprotected plants. High winds also remove organic matter, a valuable part of very sandy soils.

The length of the growing season in the county is about 160 days. The average date of the last killing frost in spring is May 1, and that of the first in fall is October 8. Probabilities for the last damaging cold temperature in spring and the first in fall are listed in table 13.

TABLE 13.— *Probabilities of last freezing temperatures in spring and first in fall*

[All data from Indian Mills, Burlington County, New Jersey]

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	March 22	April 7	April 18	May 4	May 14
2 years in 10 later than	March 18	March 31	April 12	April 28	May 9
5 years in 10 later than	March 9	March 20	April 2	April 19	May 1
Fall:					
1 year in 10 earlier than	November 18	November 2	October 14	October 6	September 28
2 years in 10 earlier than	November 23	November 8	October 20	October 12	October 3
5 years in 10 earlier than	December 1	November 17	October 31	October 21	October 8

Water Supply

Because most of the water used by industry, towns, and cities comes from underground water-bearing strata, it is important that the soils keep supplying these strata from the excess rainfall. Sandy soils transmit water readily to these strata, but clay soils transmit little water.

In some parts of the county, community development is rapidly spreading in some areas of permeable soils. Good recharge areas are being roofed over, paved, or compacted by bulldozers. Some planning is needed to insure that rainfall in sufficient amounts is transmitted to the underground layers.

Soil associations 2, 5, and 6, which are shown on the general soil map at the back of this survey, have severe limitations as transmitters of water. Soils in associations 2 and 6 are primarily slowly permeable because they are mostly clay loam or sandy clay in the upper 2 to 3 feet. Soils in association 5 are underlain by clay beds through which water passes slowly.

In the other associations the soils are permeable, though underlying clay layers occur in spots. These clay layers generally are local in extent. Soil association 10 consists mostly of rapidly permeable soils and could well serve as an area to spread waste water.

Because it is more efficient to store water underground than in impoundments, large impoundments are few in the county. Impoundments for runoff from flash floods, however, were created from the irrigation ponds when Willingboro was built. Several dug ponds were connected by pipes that discharged water from storm sewers into these ponds. This permits water to percolate to underground strata rather than to discharge immediately into the Delaware River.

In soil associations 4, 7, and 12, hundreds of dug ponds serve as sources of water for irrigation and for wildlife habitats, and some of them are recreation ponds. These dug ponds are less abundant in associations 5, 6, 8, and 10.

Development of Farming

The settlers exported considerable lumber as they cleared the land for crops. After enough land was cleared to produce needed food, tobacco, flax,. and other crops were grown extensively for export. The large farms were adjacent to settlements along the Delaware River.

In the interior of the county, the early iron furnaces and forges consumed wood in charcoal form as fast as the trees grew. Much of the acreage that produced these trees was cleared for crops. But yields of grain, hay, and fruit were so low that these crops were abandoned. The numerous forest fires halted many attempts at community development.

A substantial cranberry industry was established in the pine barrens by 1860. Later many of the small, less productive bogs, and those lacking sufficient water for frost protection and water harvesting, were abandoned. When water harvesting, was introduced, however, interest in cranberry production was renewed.

The blueberry industry started in the United States when highbush blueberries were improved so that they produced large fruit. At first wild plants were transplanted in the fields, and soon these plants were reproduced by rooted cuttings. Crossbreeding and hybridizing later produced better plants. In Burlington County highbush blueberries are grown on a large acreage. Blueberry farming has not been affected by the recent rapid expansion of residential, industrial, and commercial sites, though this expansion has reduced nearly all other kind of farming in the county.

Figure 30.—**Special irrigated crops such as sod are worth far more per acre than crops formerly grown on this farm. The soil is Colemantown loam.**

According to the Census of Agriculture, tree fruits, including apples, peaches, and pears, and nuts and grapes were grown on 12,383 acres in 1930, but by 1964, the area of these crops had decreased to 2,840 acres.

Dairy farms also have decreased rapidly. Since many farms have consolidated, milk production and the number of cows have decreased less rapidly than the number of dairy farms.

Although farm acreage is steadily decreasing, the value of farm products remains about the same. The farms generally are more productive, and more crops of high value are grown (fig. 30).

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Available moisture capacity. The capacity of a soil to hold water in a form available to plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is expressed as inches of water per inch of soil.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented—Hard and brittle; little affected by moistening.

Glauconite. A dark-green mineral, essentially a potassium iron silicate, that occurs in greensand.

Gravel. Small rock fragments ranging in size from 2 millimeters (0.079 inch) to 80 millimeters (about 3 inches).

Great soil group. A broad group of soils having internal soil characteristics in common.

Greensand. A sedimentary deposit that contains various amounts of glauconite. The texture of the deposit ranges from sand to clay.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused by (1) accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid

limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Natural soil drainage. Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and in Podzolic soils commonly have mottlings below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Organic matter (content). Ratings used in this report have the following limits: Very low—less than 1 percent by volume; low—1 to 2 percent; moderate—2 to 4 percent; and high—more than 4 percent.

Parent material, soil. The unconsolidated mass of rock material (or peat) from which the soil is formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Percolation. The downward movement of water in a wet soil, generally expressed in minutes per inch. Percolation tests also include lateral movement of water.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Quartzose. A term applied to material that is composed mainly of quartz but also contains other minerals.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.5 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Runoff. Surface drainage of rain or melted snow.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The upper surface of ground water, or that level below which the soil is seasonally saturated with water. It does not refer to the temporary saturation level during and immediately following rains and thaws. A high water table is 1 foot or less from the surface; moderately high is 1 to 2 feet from the surface.

Water table, perched. The water table of a saturated layer of soil which is separated from an underlying saturated layer by an unsaturated layer.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. The suitability of the soils for use as cropland is discussed in the soil descriptions. The capability classification is discussed on pages 54 through 56. For information on use of soils for woodland, see section beginning on page 56, including table 4, page 58. Other information is given in tables as follows:

Acreage and extent, table 1, page 8.
Estimated yields, table 2, page 53.
Use of soils for wildlife, table 5, page 62.
Engineering uses of soils, tables 6, 7, and 8, pages 66 through 99.
Limitations of soils for recreational and community developments, table 9, page 102.

Map symbol	Mapping unit	Described on page	Capability unit	Woodland suitability group
AaA	Adelphia fine sandy loam, 0 to 2 percent slopes	10	IIw-14	2w1
AaB	Adelphia fine sandy loam, 2 to 5 percent slopes	10	IIw-14	2w1
AcA	Adelphia fine sandy loam, clayey substratum, 0 to 2 percent slopes	10	IIw-14	2w1
AcB	Adelphia fine sandy loam, clayey substratum, 2 to 5 percent slopes	10	IIw-14	2w1
AhA	Adelphia loam, 0 to 2 percent slopes	10	IIw-13	2w1
Ak	Adelphia sandy clay loam, truncated	10	IIw-13	2w1
AnA	Adelphia fine sandy loam, glauconitic variant, 0 to 2 percent slopes	11	IIw-14	2w1
AnB	Adelphia fine sandy loam, glauconitic variant, 2 to 5 percent slopes	11	IIw-14	2w1
Ao	Alluvial land, loamy	11	VIw-28	1w1
Ap	Alluvial land, sandy	12	VIw-28	3w1
At	Atsion sand	13	Vw-22	3w1
Au	Atsion sand, loamy substratum	13	Vw-22	3w1
Av	Atsion fine sand	13	Vw-22	3w1
Aw	Atsion fine sand, loamy substratum	13	Vw-22	3w1
Bp	Berryland sand	15	Vw-26	3w1
Bt	Berryland fine sand	15	Vw-26	3w1
Bu	Berryland mucky sand	15	Vw-26	3w1
Cm	Colemantown loam	16	IIIw-20	3w2
CnA	Collington fine sandy loam, 0 to 2 percent slopes	17	I-5	1o1
CnB	Collington fine sandy loam, 2 to 5 percent slopes	17	IIe-5	1o1
CnC	Collington fine sandy loam, 5 to 10 percent slopes	17	IIIe-5	1o1
CoA	Collington loam, 0 to 2 percent slopes	17	I-4	1o1
CoB	Collington loam, 2 to 5 percent slopes	17	IIe-4	1o1
DeB	Donlonton fine sandy loam, 0 to 3 percent slopes	18	IIw-12	2w1
DlA	Donlonton loam, 0 to 3 percent slopes	18	IIw-11	2w1
DoA	Downer loamy sand, 0 to 2 percent slopes	19	IIs-6	3o1
DoB	Downer loamy sand, 2 to 5 percent slopes	19	IIs-6	3o1
DoC	Downer loamy sand, 5 to 10 percent slopes	19	IIIe-6	3o1
DpB	Downer loamy sand, gravelly substratum, 0 to 5 percent slopes	19	IIs-6	3o1
DrA	Downer loamy sand, loamy substratum, 0 to 2 percent slopes	19	IIs-6	3o1
DsB	Downer sandy loam, truncated, 0 to 5 percent slopes	20	IIIe-6	3o1
EvB	Evesboro sand, 0 to 5 percent slopes	20	VIIs-7	3s1
EvC	Evesboro sand, 5 to 10 percent slopes	20	VIIs-7	3s1
EwB	Evesboro sand, loamy substratum, 0 to 5 percent slopes	20	IVs-7	3s1
EyB	Evesboro fine sand, 0 to 5 percent slopes	20	IVs-7	3s1
Fa	Fallsington fine sandy loam	21	IIIw-21	3w2
Fc	Fallsington fine sandy loam, clayey substratum	21	IIIw-21	3w2
FfA	Freehold fine sandy loam, 0 to 2 percent slopes	22	I-5	1o1
FfB	Freehold fine sandy loam, 2 to 5 percent slopes	22	IIe-5	1o1
FfC	Freehold fine sandy loam, 5 to 10 percent slopes	23	IIIe-5	1o1
FfD	Freehold fine sandy loam, 10 to 15 percent slopes	23	IVe-5	1o1
FfE	Freehold fine sandy loam, 15 to 25 percent slopes	23	VIe-5	1r1
FgB	Freehold fine sandy loam, clayey substratum, 2 to 5 percent slopes	23	IIe-5	1o1

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GUIDE TO MAPPING UNITS.--Continued

Map symbol	Mapping unit	Described on page	Capability unit	Woodland suitability group
FhB	Freehold loamy sand, 0 to 5 percent slopes	23	IIs-6	2o1
FhC	Freehold loamy sand, 5 to 10 percent slopes	23	IIIe-6	2o1
FoC3	Freehold sandy loam, 5 to 10 percent slopes, severely eroded	23	IVe-5	1o1
FoD3	Freehold sandy loam, 10 to 15 percent slopes, severely eroded	23	VIe-5	1o1
GaA	Galestown sand, 0 to 5 percent slopes	24	IVs-7	3s1
GcB	Galestown sand, clayey substratum, 0 to 5 percent slopes	24	IVs-7	3s1
HdA	Holmdel fine sandy loam, 0 to 2 percent slopes	25	IIw-14	2w1
HdB	Holmdel fine sandy loam, 2 to 5 percent slopes	25	IIw-14	2w1
HlB	Holmdel loamy sand, 0 to 5 percent slopes	25	IIIw-15	2w1
HmA	Holmdel fine sandy loam, clayey substratum, 0 to 2 percent slopes	26	IIw-14	2w1
HmB	Holmdel fine sandy loam, clayey substratum, 2 to 5 percent slopes	26	IIw-14	2w1
Hn	Holmdel-Urban land complex	26	-----	---
Ka	Keansburg fine sandy loam	27	IIIw-25	3w2
KeB	Keyport loamy sand, 0 to 5 percent slopes	28	IIe-3	2w1
KfB	Keyport fine sandy loam, 2 to 5 percent slopes	28	IIe-2	2w1
KlA	Keyport loam, 0 to 2 percent slopes	28	IIw-1	2w1
KlB	Keyport loam, 2 to 5 percent slopes	28	IIe-1	2w1
KlC	Keyport loam, 5 to 10 percent slopes	28	IIIe-1	2w1
KlD	Keyport loam, 10 to 15 percent slopes	28	VIe-1	2w1
KlE	Keyport loam, 15 to 25 percent slopes	28	VIIe-1	2r1
KmA	Klej sand, 0 to 4 percent slopes	29	IIIw-16	3s1
KnA	Klej sand, loamy substratum, 0 to 2 percent slopes	29	IIIw-16	3s1
KoA	Klej fine sand, 0 to 2 percent slopes	30	IIIw-16	3s1
KwA	Kresson loamy sand, 0 to 3 percent slopes	31	IIIw-12	2w1
KxA	Kresson fine sandy loam, 0 to 3 percent slopes	31	IIIw-12	2w1
KyA	Kresson loam, 0 to 3 percent slopes	31	IIIw-11	2w1
LaA	Lakehurst sand, 0 to 3 percent slopes	32	IVw-17	4s1
LlA	Lakehurst sand, thick surface, 0 to 3 percent slopes	32	IVw-17	4s1
LmA	Lakehurst sand, loamy substratum, 0 to 3 percent slopes	32	IVw-17	4s1
LnA	Lakehurst fine sand, 0 to 3 percent slopes	32	IVw-17	4s1
LoA	Lakehurst fine sand, loamy substratum, 0 to 3 percent slopes	33	IVw-17	4s1
LrA	Lakehurst-Lakewood sands, 0 to 5 percent slopes	33	IVw-17	4s1
LsA	Lakehurst-Lakewood sands, loamy substratum, 0 to 5 percent slopes	33	IVw-17	4s1
LtB	Lakewood sand, 0 to 5 percent slopes	34	VIIs-8	5s1
LtC	Lakewood sand, 5 to 10 percent slopes	34	VIIs-8	5s1
LtD	Lakewood sand, 10 to 15 percent slopes	34	VIIs-8	5s1
LuB	Lakewood sand, thick surface, 0 to 5 percent slopes	34	VIIs-8	5s1
LvB	Lakewood sand, loamy substratum, 0 to 5 percent slopes	34	VIIs-8	5s1
LwB	Lakewood fine sand, 0 to 5 percent slopes	34	VIIs-8	5s1
LyA	Lakewood fine sand, loamy substratum, 0 to 5 percent slopes	34	VIIs-8	5s1
Ma	Made land, dredged coarse material	34	-----	---
Mf	Made land, dredged fine material	35	-----	---
Mg	Made land, sanitary fill	35	-----	---
MhA	Marlton fine sandy loam, 0 to 2 percent slopes	36	IIs-2	2o1
MhB	Marlton fine sandy loam, 2 to 5 percent slopes	36	IIe-2	2o1
MrC	Marlton soils, 5 to 10 percent slopes	36	IIIe-2	2o1
Ms	Marsh, fresh water	37	VIIIw-29	---
Mt	Marsh, tidal	37	VIIIw-29	---
Mu	Muck, shallow	37	VIIw-30	3w3
NbA	Nixonton fine sandy loam, 0 to 2 percent slopes	39	IIw-14	2w1
NbB	Nixonton fine sandy loam, 2 to 5 percent slopes	39	IIw-14	2w1

Map symbol	Mapping unit	Described on page	Capability unit	Woodland suitability group
NcA	Nixonton loamy fine sand, 0 to 2 percent slopes--------	39	IIw-15	2w1
NcB	Nixonton loamy fine sand, 2 to 5 percent slopes--------	39	IIw-15	2w1
Pa	Pasquotank fine sandy loam----------------------------	40	IIIw-20	3w2
PbA	Pemberton sand, 0 to 5 percent slopes-----------------	41	IIIw-15	3s1
PcA	Pemberton sand, thick surface, 0 to 5 percent slopes---	41	IIIw-16	3s1
Pt	Pits, sand and gravel---------------------------------	41	-----	---
Pu	Pits, clay and marl-----------------------------------	41	-----	---
Pv	Pocomoke fine sandy loam------------------------------	42	IIIw-24	3w2
Se	Sandy land, ironstone---------------------------------	42	VIIs-8	3s1
SfB	Sassafras loamy sand, 0 to 5 percent slopes-----------	43	IIs-6	2o1
SgA	Sassafras fine sandy loam, 0 to 2 percent slopes-------	44	I-5	2o1
SgB	Sassafras fine sandy loam, 2 to 5 percent slopes-------	44	IIe-5	2o1
SgC	Sassafras fine sandy loam, 5 to 10 percent slopes------	44	IIIe-5	2o1
ShA	Sassafras fine sandy loam, clayey substratum, 0 to 2 percent slopes--------------------------------------	44	I-5	2o1
ShB	Sassafras fine sandy loam, clayey substratum, 2 to 5 percent slopes--------------------------------------	44	IIe-5	2o1
Sk	Sassafras-Urban land complex--------------------------	45	-----	---
Sm	Sassafras-Urban land complex, clayey substrata--------	45	-----	---
Sn	Shrewsbury fine sandy loam----------------------------	46	IIIw-21	3w2
So	Shrewsbury fine sandy loam, clayey substratum---------	46	IIIw-21	3w2
Sp	Shrewsbury loam---------------------------------------	46	IIIw-20	3w2
Sv	Shrewsbury sandy clay loam, truncated-----------------	46	IIIw-20	3w2
Sx	Shrewsbury fine sandy loam, ironstone variant----------	47	IVw-21	3w2
TsB	Tinton sand, 0 to 5 percent slopes--------------------	47	IIIs-6	3s1
TsC	Tinton sand, 5 to 10 percent slopes-------------------	48	IVs-7	3s1
TtB	Tinton sand, thick surface, 0 to 5 percent slopes------	48	IVs-7	3s1
Ug	Urban land, sandy-------------------------------------	48	-----	---
Ut	Urban land, clayey------------------------------------	48	-----	---
Uv	Urban land, sandy over clayey-------------------------	48	-----	---
WaA	Westphalia loamy fine sand, 0 to 2 percent slopes------	49	IIs-6	2o1
WaB	Westphalia loamy fine sand, 2 to 5 percent slopes------	49	IIs-6	2o1
WdA	Westphalia fine sandy loam, 0 to 2 percent slopes------	49	I-5	2o1
WdB	Westphalia fine sandy loam, 2 to 5 percent slopes------	49	IIe-5	2o1
WeB	Woodmansie sand, 0 to 5 percent slopes----------------	50	IVs-8	4s1
WeC	Woodmansie sand, 5 to 10 percent slopes---------------	50	IVs-8	4s1
WgB	Woodmansie sand, firm substratum, 2 to 5 percent slopes---	50	IVs-8	4s1
WhB	Woodmansie sand, loamy substratum, 0 to 5 percent slopes---	50	IVs-8	4s1
WkA	Woodstown loamy sand, 0 to 2 percent slopes-----------	51	IIIw-15	2w1
WlA	Woodstown loamy sand, loamy substratum, 0 to 2 percent slopes---	51	IIIw-15	2w1
WmA	Woodstown fine sandy loam, 0 to 2 percent slopes-------	51	IIw-14	2w1
WmB	Woodstown fine sandy loam, 2 to 5 percent slopes-------	52	IIw-14	2w1
WnA	Woodstown fine sandy loam, clayey substratum, 0 to 2 percent slopes--------------------------------------	52	IIw-14	2w1
WnB	Woodstown fine sandy loam, clayey substratum, 2 to 5 percent slopes--------------------------------------	52	IIw-14	2w1

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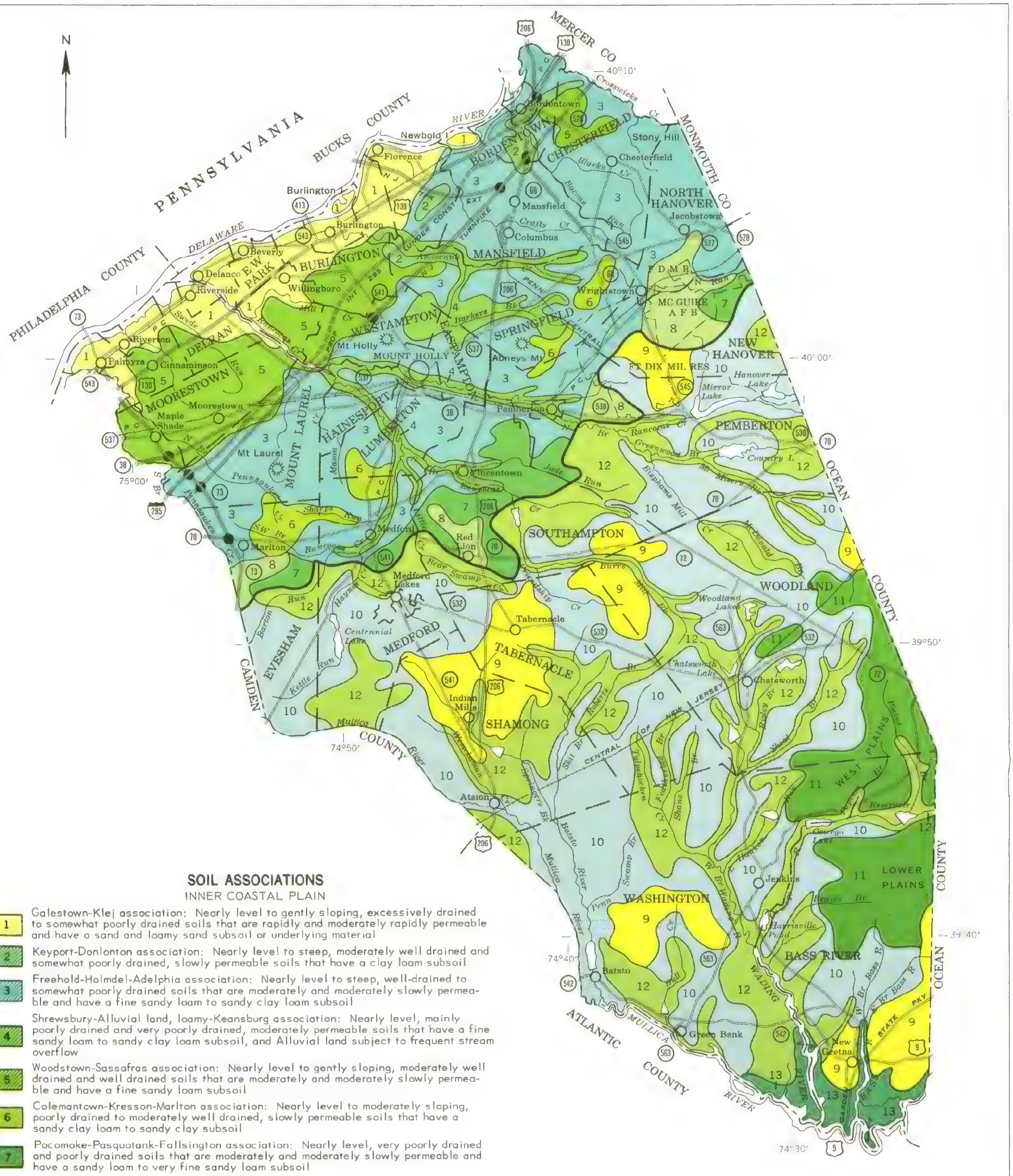


SOIL ASSOCIATIONS

INNER COASTAL PLAIN

1	Galestown-Klej association: Nearly level to gently sloping, excessively drained to somewhat poorly drained soils that are rapidly and moderately rapidly permeable and have a sand and loamy sand subsoil or underlying material
2	Keyport-Donlonton association: Nearly level to steep, moderately well drained and somewhat poorly drained, slowly permeable soils that have a clay loam subsoil
3	Freehold-Holmdel-Adelphia association: Nearly level to steep, well-drained to somewhat poorly drained soils that are moderately and moderately slowly permeable and have a fine sandy loam to sandy clay loam subsoil
4	Shrewsbury-Alluvial land, loamy-Keansburg association: Nearly level, mainly poorly drained and very poorly drained, moderately permeable soils that have a fine sandy loam to sandy clay loam subsoil, and Alluvial land subject to frequent stream overflow
5	Woodstown-Sassafras association: Nearly level to gently sloping, moderately well drained and well drained soils that are moderately and moderately slowly permeable and have a fine sandy loam subsoil
6	Colemantown-Kresson-Marlton association: Nearly level to moderately sloping, poorly drained to moderately well drained, slowly permeable soils that have a sandy clay loam to sandy clay subsoil
7	Pocomoke-Pasquotank-Fallsington association: Nearly level, very poorly drained and poorly drained soils that are moderately and moderately slowly permeable and have a sandy loam to very fine sandy loam subsoil
8	Nixonton-Westphalia association: Nearly level to gently sloping, moderately well drained and well drained soils that are moderately slowly permeable and have a very fine sandy loam to fine sandy loam subsoil

OUTER COASTAL PLAIN

9	Downer-Sassafras-Woodstown association: Nearly level to gently sloping, well drained and moderately well drained soils that are moderately and moderately slowly permeable and have a sandy loam and fine sandy loam subsoil
10	Lakehurst-Lakewood-Evesboro association: Nearly level to strongly sloping, somewhat poorly drained to excessively drained soils that are rapidly and moderately rapidly permeable and have a loamy sand and sand subsoil or underlying material
11	Woodmansie-Lakehurst association: Nearly level to gently sloping, well-drained to somewhat poorly drained soils that are rapidly and moderately rapidly permeable and have a sand to sandy loam subsoil
12	Atsion-Muck-Alluvial land, sandy, association: Nearly level, poorly drained soils that are moderately rapidly permeable and have a sand and loamy sand subsoil, and very poorly drained Muck and Alluvial land subject to frequent flooding from streams
13	Tidal Marsh association: Organic silts subject to daily flooding, along the Mullica and Wading Rivers

June 1970

NOTE –

This map is intended for general planning. Each delineation may contain soils having ratings different from those shown on the map. Use detailed soil maps for operational planning.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NEW JERSEY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

BURLINGTON COUNTY, NEW JERSEY

Scale 1 : 253,440

1 0 1 2 3 4 Miles

INDEX TO MAP SHEETS

BURLINGTON COUNTY, NEW JERSEY

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, or E, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. A final number, 3, in the symbol shows that the soil is severely eroded.

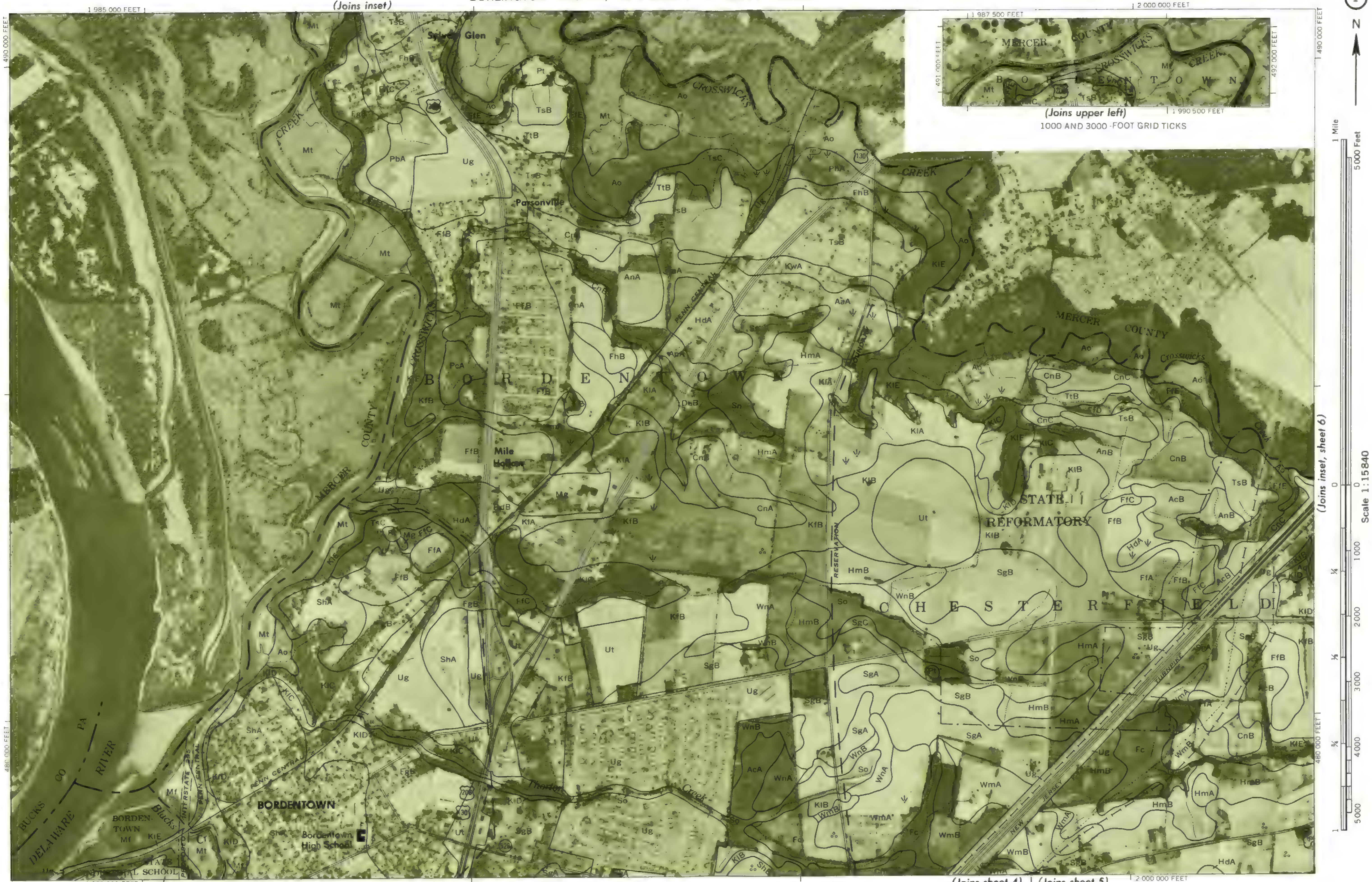
SYMBOL	NAME
AaA	Adelphia fine sandy loam, 0 to 2 percent slopes
AaB	Adelphia fine sandy loam, 2 to 5 percent slopes
AcA	Adelphia fine sandy loam, clayey substratum, 0 to 2 percent slopes
AcB	Adelphia fine sandy loam, clayey substratum, 2 to 5 percent slopes
AhA	Adelphia loam, 0 to 2 percent slopes
Ak	Adelphia sandy clay loam, truncated
AnA	Adelphia fine sandy loam, glauconitic variant, 0 to 2 percent slopes
AnB	Adelphia fine sandy loam, glauconitic variant, 2 to 5 percent slopes
Ao	Alluvial land, loamy
Ap	Alluvial land, sandy
At	Atsion sand
Au	Atsion sand, loamy substratum
Av	Atsion fine sand
Aw	Atsion fine sand, loamy substratum
Bp	Berryland sand
Bt	Berryland fine sand
Bu	Berryland mucky sand
Cm	Colemantown loam
CnA	Collington fine sandy loam, 0 to 2 percent slopes
CnB	Collington fine sandy loam, 2 to 5 percent slopes
CnC	Collington fine sandy loam, 5 to 10 percent slopes
CoA	Collington loam, 0 to 2 percent slopes
CoB	Collington loam, 2 to 5 percent slopes
DeB	Donlonton fine sandy loam, 0 to 3 percent slopes
DlA	Donlonton loam, 0 to 3 percent slopes
DoA	Downer loamy sand, 0 to 2 percent slopes
DoB	Downer loamy sand, 2 to 5 percent slopes
DoC	Downer loamy sand, 5 to 10 percent slopes
DpB	Downer loamy sand, gravelly substratum, 0 to 5 percent slopes
DrA	Downer loamy sand, loamy substratum, 0 to 2 percent slopes
DsB	Downer sandy loam, truncated, 0 to 5 percent slopes
EvB	Evesboro sand, 0 to 5 percent slopes
EvC	Evesboro sand, 5 to 10 percent slopes
EwB	Evesboro sand, loamy substratum, 0 to 5 percent slopes
EyB	Evesboro fine sand, 0 to 5 percent slopes
Fa	Fallsington fine sandy loam
Fc	Fallsington fine sandy loam, clayey substratum
FfA	Freehold fine sandy loam, 0 to 2 percent slopes
FfB	Freehold fine sandy loam, 2 to 5 percent slopes
FfC	Freehold fine sandy loam, 5 to 10 percent slopes
FfD	Freehold fine sandy loam, 10 to 15 percent slopes
FfE	Freehold fine sandy loam, 15 to 25 percent slopes
FgB	Freehold fine sandy loam, clayey substratum, 2 to 5 percent slopes
FhB	Freehold loamy sand, 0 to 5 percent slopes
FhC	Freehold loamy sand, 5 to 10 percent slopes
FoC3	Freehold sandy loam, 5 to 10 percent slopes, severely eroded
FoD3	Freehold sandy loam, 10 to 15 percent slopes, severely eroded
GaA	Galestown sand, 0 to 5 percent slopes
GcB	Galestown sand, clayey substratum, 0 to 5 percent slopes

SYMBOL	NAME
HdA	Holmdel fine sandy loam, 0 to 2 percent slopes
HdB	Holmdel fine sandy loam, 2 to 5 percent slopes
HlB	Holmdel loamy sand, 0 to 5 percent slopes
HmA	Holmdel fine sandy loam, clayey substratum, 0 to 2 percent slopes
HmB	Holmdel fine sandy loam, clayey substratum, 2 to 5 percent slopes
Hn	Holmdel-Urban land complex
Ka	Keansburg fine sandy loam
KeB	Keyport loamy sand, 0 to 5 percent slopes
KfB	Keyport fine sandy loam, 2 to 5 percent slopes
KlA	Keyport loam, 0 to 2 percent slopes
KlB	Keyport loam, 2 to 5 percent slopes
KlC	Keyport loam, 5 to 10 percent slopes
KlD	Keyport loam, 10 to 15 percent slopes
KlE	Keyport loam, 15 to 25 percent slopes
KmA	Klej sand, 0 to 4 percent slopes
KnA	Klej sand, loamy substratum, 0 to 2 percent slopes
KoA	Klej fine sand, 0 to 2 percent slopes
KwA	Kresson loamy sand, 0 to 3 percent slopes
KxA	Kresson fine sandy loam, 0 to 3 percent slopes
KyA	Kresson loam, 0 to 3 percent slopes
LaA	Lakehurst sand, 0 to 3 percent slopes
LlA	Lakehurst sand, thick surface, 0 to 3 percent slopes
LmA	Lakehurst sand, loamy substratum, 0 to 3 percent slopes
LnA	Lakehurst fine sand, 0 to 3 percent slopes
LoA	Lakehurst fine sand, loamy substratum, 0 to 3 percent slopes
LrA	Lakehurst-Lakewood sands, 0 to 5 percent slopes
LsA	Lakehurst-Lakewood sands, loamy substratum, 0 to 5 percent slopes
LtB	Lakewood sand, 0 to 5 percent slopes
LtC	Lakewood sand, 5 to 10 percent slopes
LtD	Lakewood sand, 10 to 15 percent slopes
LuB	Lakewood sand, thick surface, 0 to 5 percent slopes
LvB	Lakewood sand, loamy substratum, 0 to 5 percent slopes
LwB	Lakewood fine sand, 0 to 5 percent slopes
LyA	Lakewood fine sand, loamy substratum, 0 to 5 percent slopes
Ma	Made land, dredged coarse material
Mf	Made land, dredged fine material
Mg	Made land, sanitary fill
MhA	Marlton fine sandy loam, 0 to 2 percent slopes
MhB	Marlton fine sandy loam, 2 to 5 percent slopes
MrC	Marlton soils, 5 to 10 percent slopes
Ms	Marsh, fresh water
Mt	Marsh, tidal
Mu	Muck, shallow
NbA	Nixonton fine sandy loam, 0 to 2 percent slopes
NbB	Nixonton fine sandy loam, 2 to 5 percent slopes
NcA	Nixonton loamy fine sand, 0 to 2 percent slopes
NcB	Nixonton loamy fine sand, 2 to 5 percent slopes
Pa	Pasquotank fine sandy loam
PbA	Pemberton sand, 0 to 5 percent slopes
PcA	Pemberton sand, thick surface, 0 to 5 percent slopes
Pt	Pits, sand and gravel
Pu	Pits, clay and marl
Pv	Pocomoke fine sandy loam

SYMBOL	NAME
Se	Sandy land, ironstone
SfB	Sassafras loamy sand, 0 to 5 percent slopes
SgA	Sassafras fine sandy loam, 0 to 2 percent slopes
SgB	Sassafras fine sandy loam, 2 to 5 percent slopes
SgC	Sassafras fine sandy loam, 5 to 10 percent slopes
ShA	Sassafras fine sandy loam, clayey substratum, 0 to 2 percent slopes
ShB	Sassafras fine sandy loam, clayey substratum, 2 to 5 percent slopes
Sk	Sassafras-Urban land complex
Sm	Sassafras-Urban land complex, clayey substrata
Sn	Shrewsbury fine sandy loam
So	Shrewsbury fine sandy loam, clayey substratum
Sp	Shrewsbury loam
Sv	Shrewsbury sandy clay loam, truncated
Sx	Shrewsbury fine sandy loam, ironstone variant
TsB	Tinton sand, 0 to 5 percent slopes
TsC	Tinton sand, 5 to 10 percent slopes
TtB	Tinton sand, thick surface, 0 to 5 percent slopes
Ug	Urban land, sandy
Ut	Urban land, clayey
Uv	Urban land, sandy over clayey
WaA	Westphalia loamy fine sand, 0 to 2 percent slopes
WaB	Westphalia loamy fine sand, 2 to 5 percent slopes
WdA	Westphalia fine sandy loam, 0 to 2 percent slopes
WdB	Westphalia fine sandy loam, 2 to 5 percent slopes
WeB	Woodmansie sand, 0 to 5 percent slopes
WeC	Woodmansie sand, 5 to 10 percent slopes
WgB	Woodmansie sand, firm substratum, 2 to 5 percent slopes
WhB	Woodmansie sand, loamy substratum, 0 to 5 percent slopes
WkA	Woodstown loamy sand, 0 to 2 percent slopes
WlA	Woodstown loamy sand, loamy substratum, 0 to 2 percent slopes
WmA	Woodstown fine sandy loam, 0 to 2 percent slopes
WmB	Woodstown fine sandy loam, 2 to 5 percent slopes
WnA	Woodstown fine sandy loam, clayey substratum, 0 to 2 percent slopes
WnB	Woodstown fine sandy loam, clayey substratum, 2 to 5 percent slopes

Soil map constructed 1970 by Cartographic Division, Soil Conservation Service, USDA, from 1963 aerial photographs. Controlled mosaic based on New Jersey plane coordinate system, transverse Mercator projection, 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 1



BURLINGTON COUNTY, NEW JERSEY NO. 1

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 2

(Joins sheet 3)

(Joins sheet 7)

BURLINGTON COUNTY, NEW JERSEY NO. 2

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

3

N

1 960 000 FEET

1 975 000 FEET

1 960 000 FEET

1 975 000 FEET

475 000 FEET

465 000 FEET

1 Mile

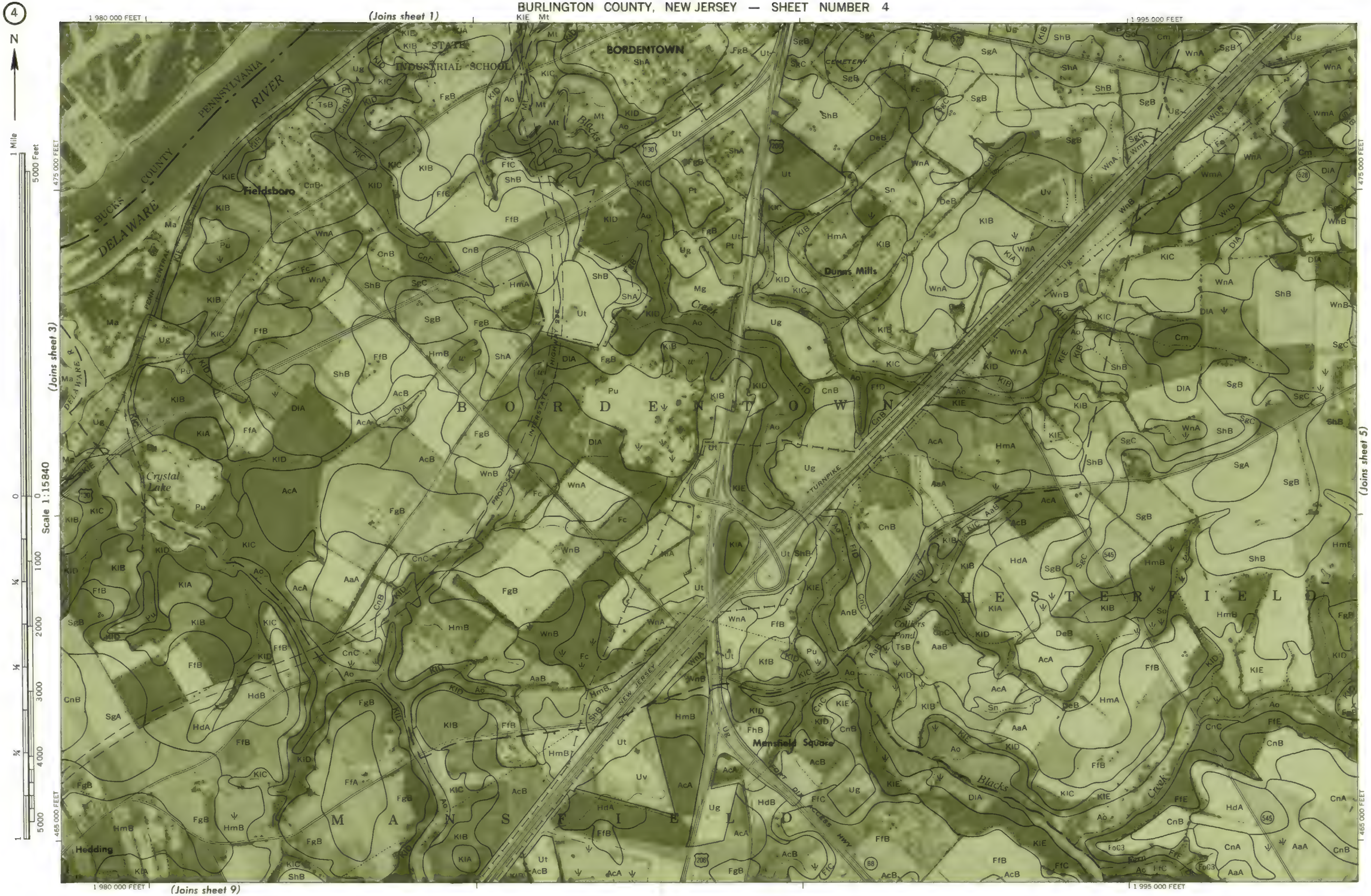
5000 Feet

Scale 1:15840

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 3

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 4



BURLINGTON COUNTY, NEW JERSEY NO. 4

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

5

(Joins sheet 1) | (Joins inset, sheet 6)

2 000 000 FEET

2 015 000 FEET

N

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 5

(Joins sheet 4)

475 000 FEET

465 000 FEET

(Joins sheet 6)

(Joins sheet 10)

2 000 000 FEET

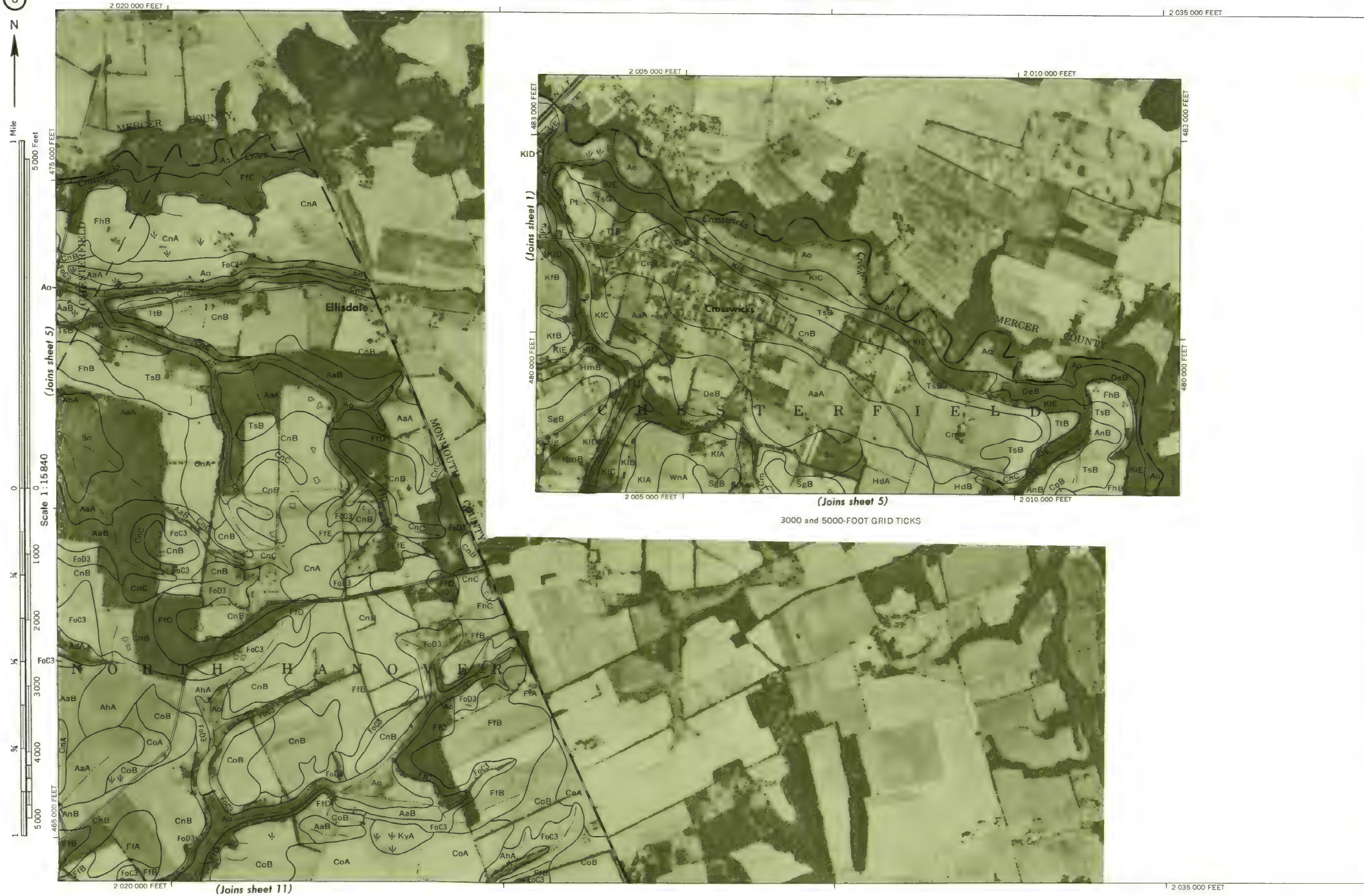
2 015 000 FEET

1 Mile

5000 Feet

Scale 1:15840

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 6



BURLINGTON COUNTY, NEW JERSEY NO. 6

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

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BURLINGTON COUNTY, NEW JERSEY NO. 7

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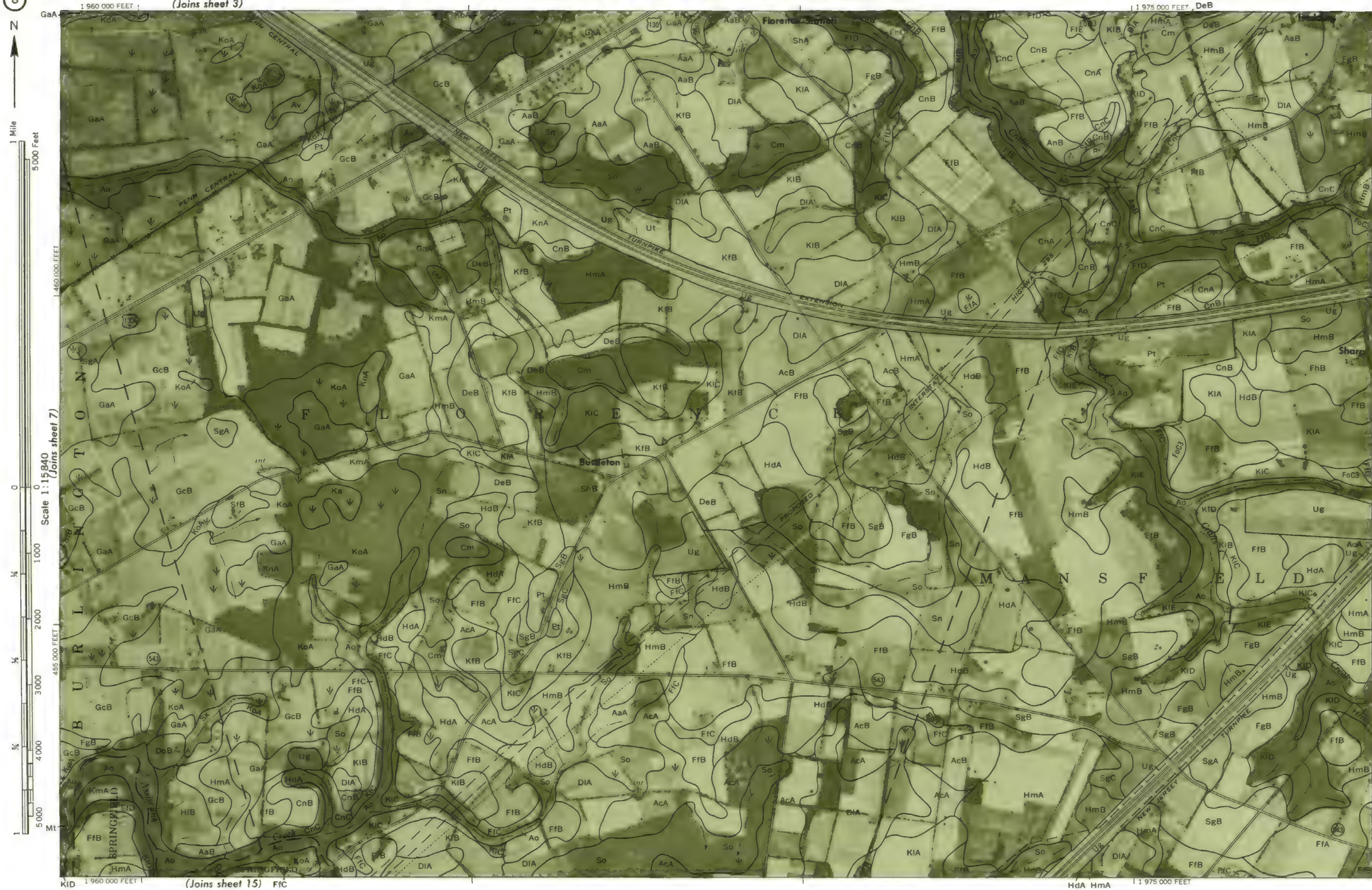
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.



BURLINGTON COUNTY, NEW JERSEY NO. 8

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

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BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 9

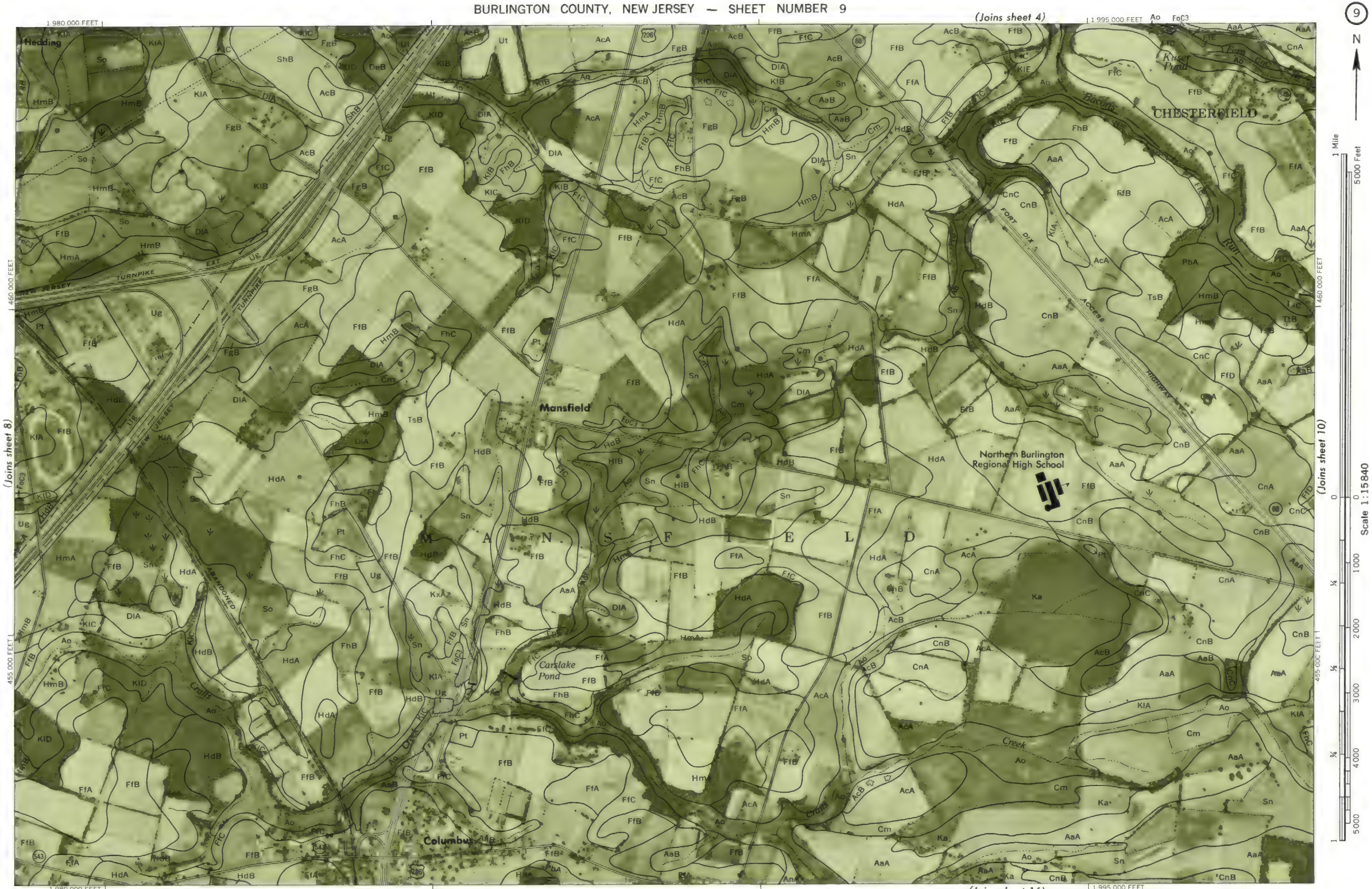

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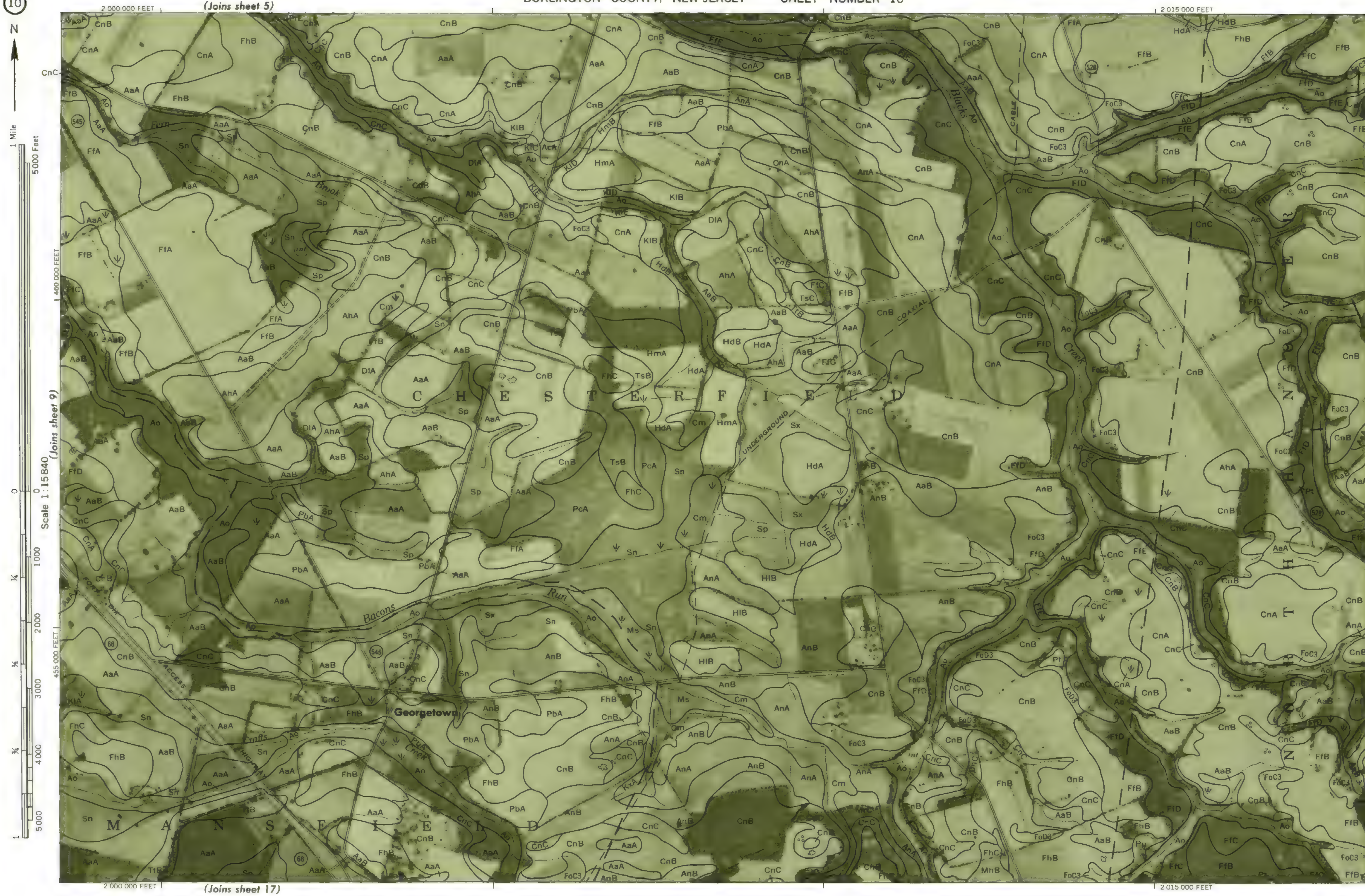
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 9

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 10



BURLINGTON COUNTY, NEW JERSEY NO. 10

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(100)

(Joins sheet 97)

2 060 000 FEET

2 075 000 FEET

N

(Joins sheet 99)

Scale 1:15840

1 Mile

5000 Feet

0

¼

½

¾

1

1000

2000

3000

4000

5000

2 060 000 FEET

2 075 000 FEET

(Joins sheet 101) | (Joins inset, sheet 101)

BURLINGTON COUNTY, NEW JERSEY NO. 100

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

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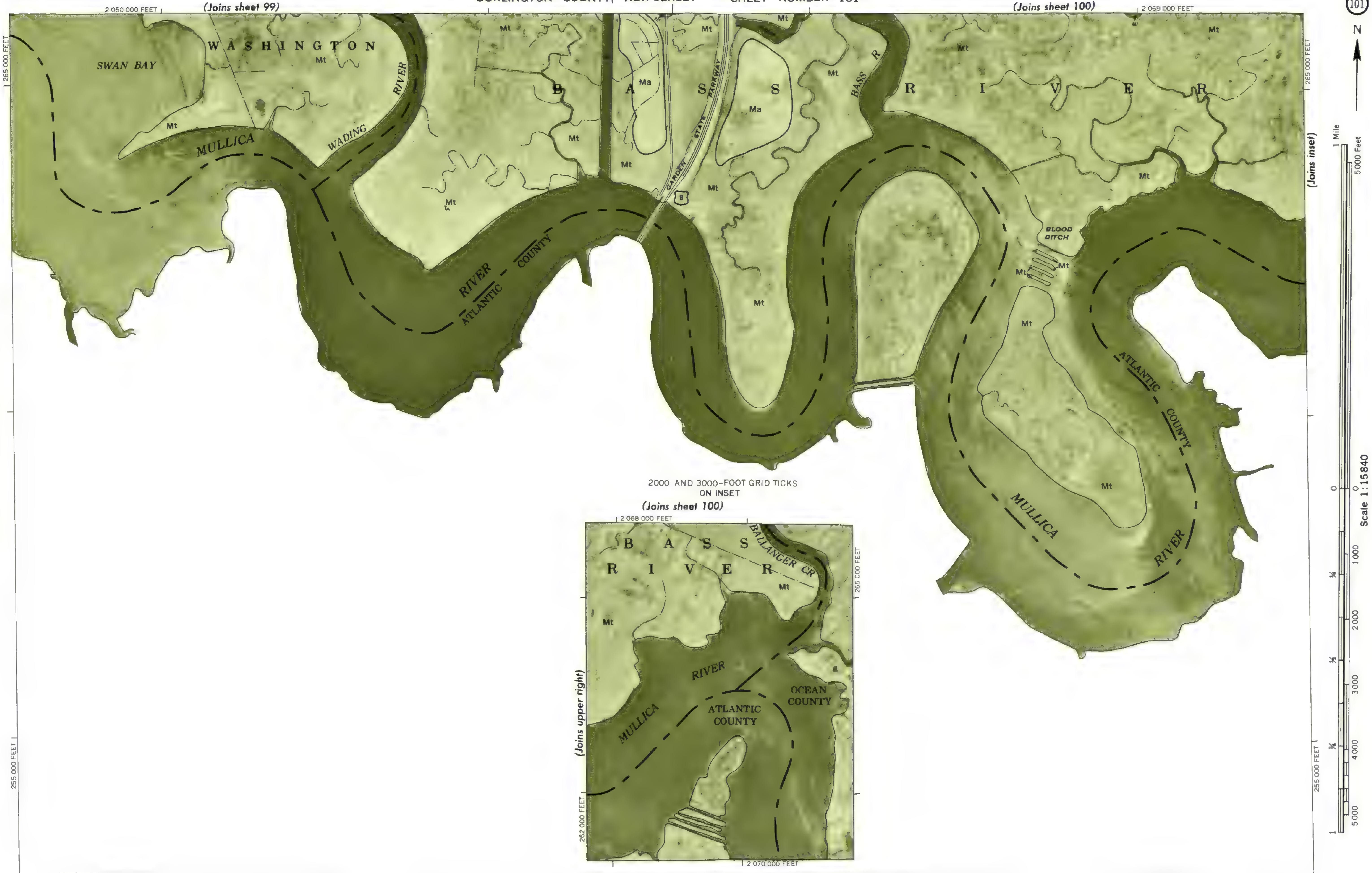

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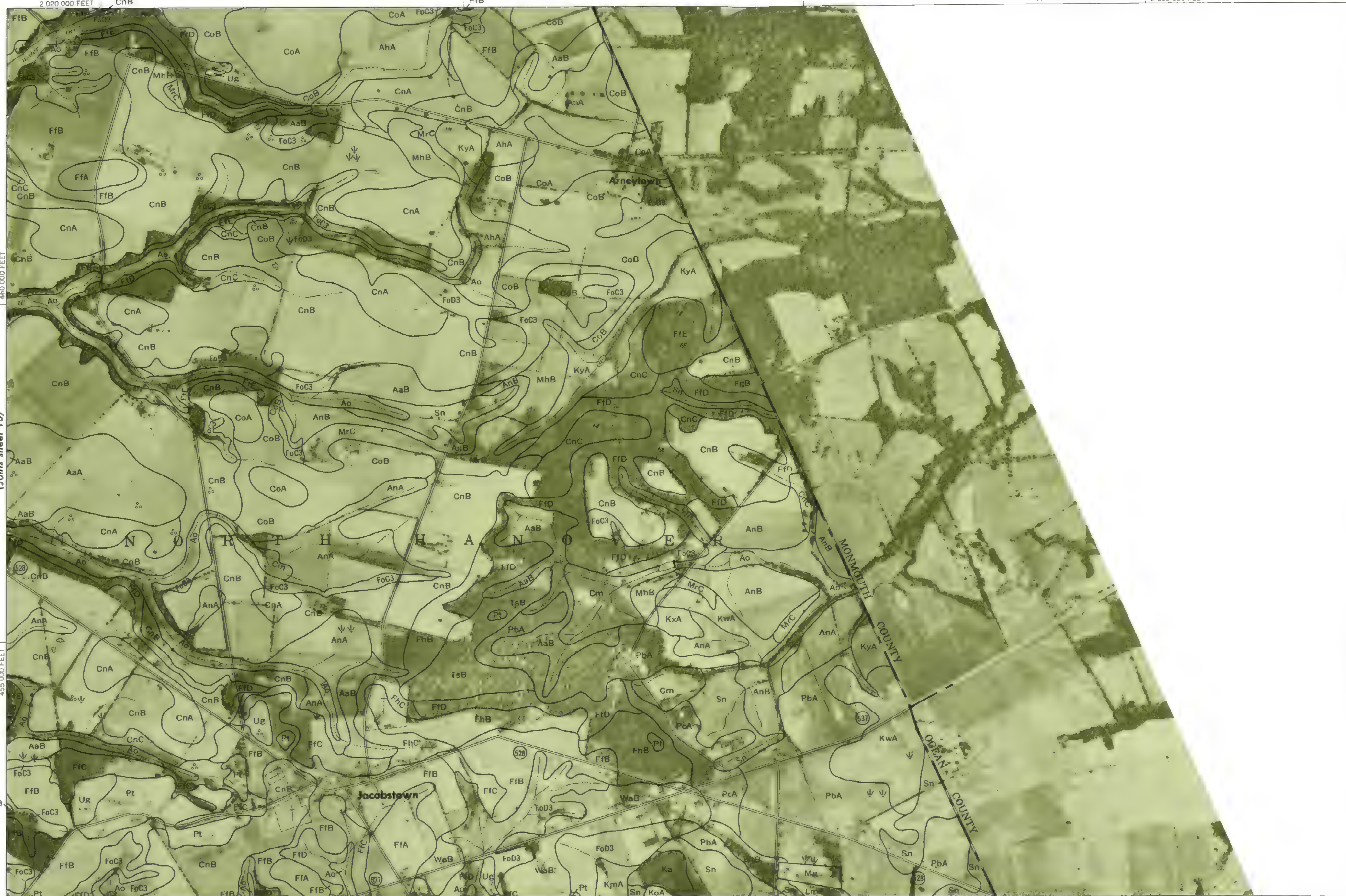
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 101



N

Scale 1:15840

1 Mile

5000 Feet

0 1000 2000 3000 4000 5000

BURLINGTON COUNTY, NEW JERSEY NO. 11

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Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 12

BURLINGTON COUNTY, NEW JERSEY NO. 12

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

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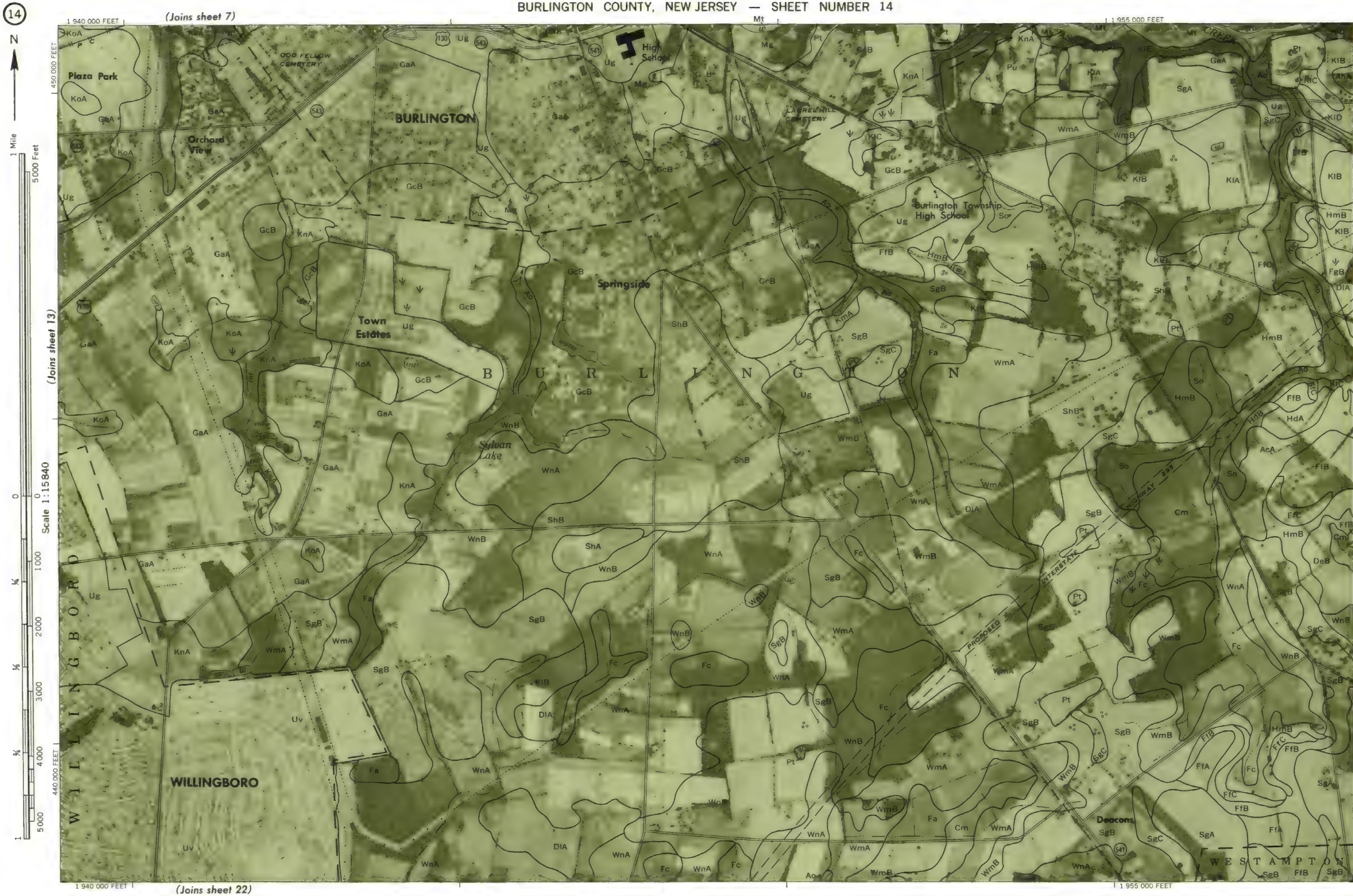
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 13

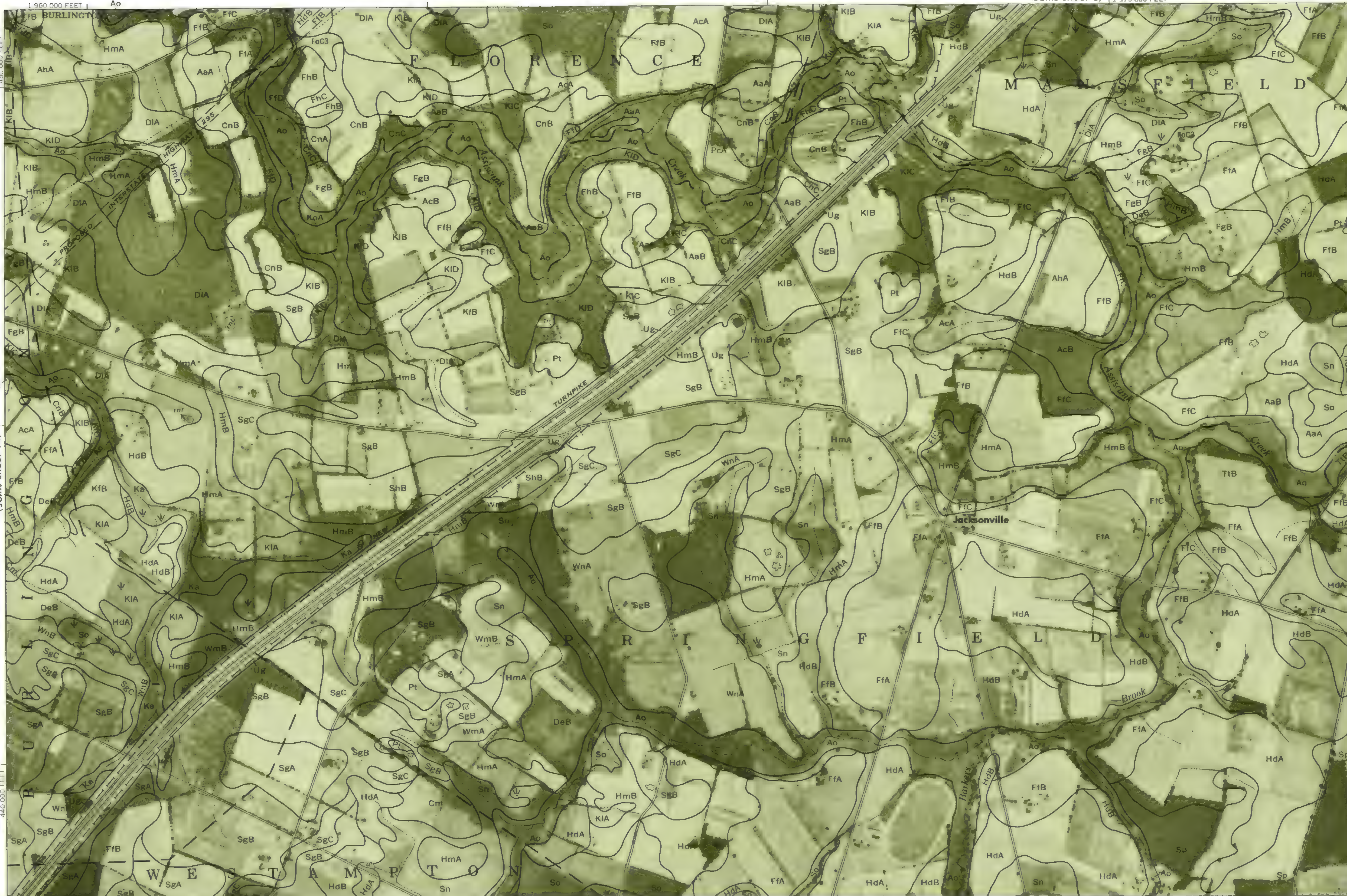


BURLINGTON COUNTY, NEW JERSEY NO. 14

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(Joins sheet 8)



(Joins sheet 14)

(Joins sheet 16)

(Joins sheet 23)

N

1 Mile

5000 Feet

Scale 1:15 840

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 15

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 16

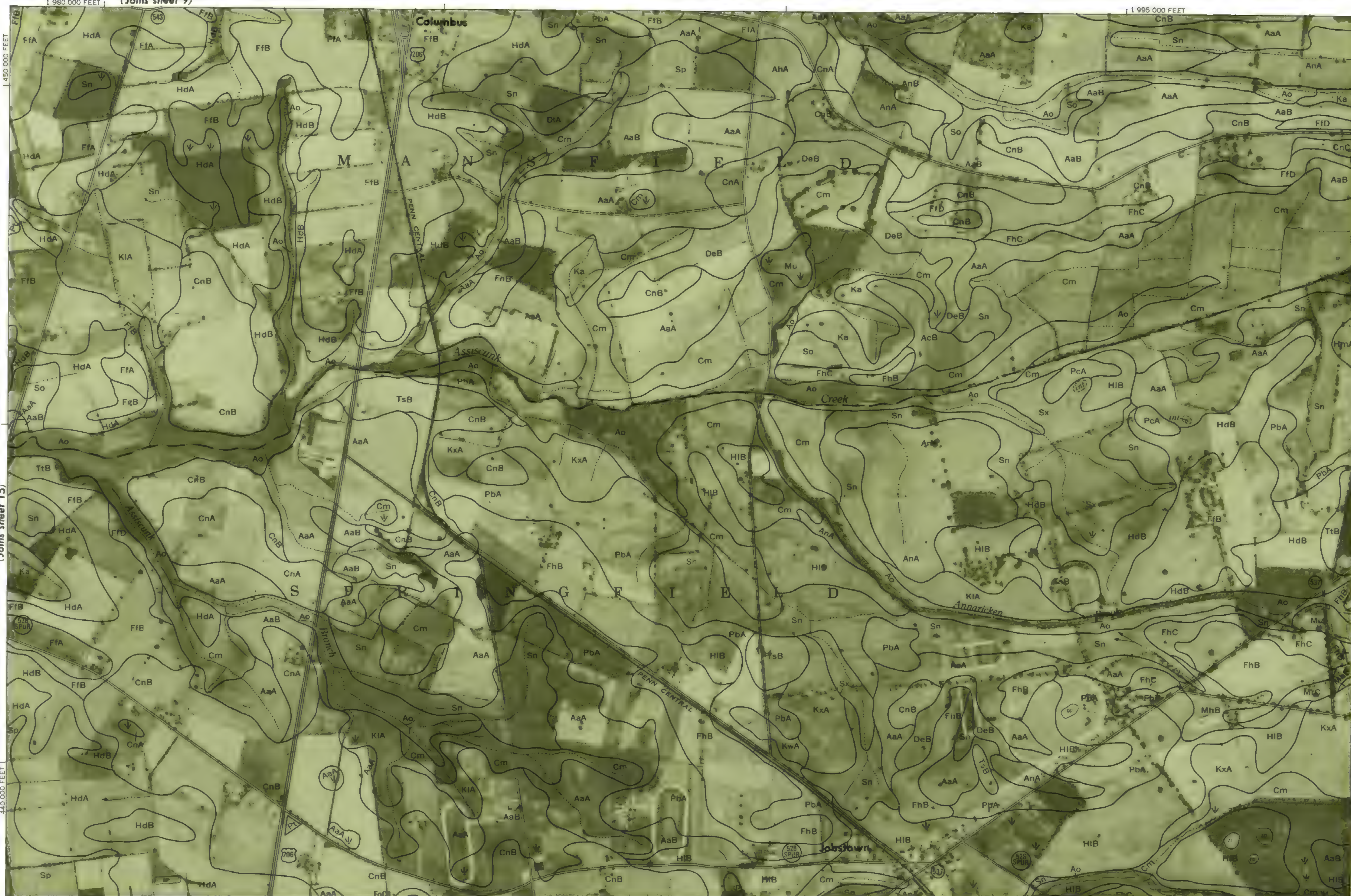
N

1 Mile 5000 Feet

Scale 1:15840

(Joins sheet 9)

(Joins sheet 15)



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(Joins sheet 24)

BURLINGTON COUNTY, NEW JERSEY NO. 16

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

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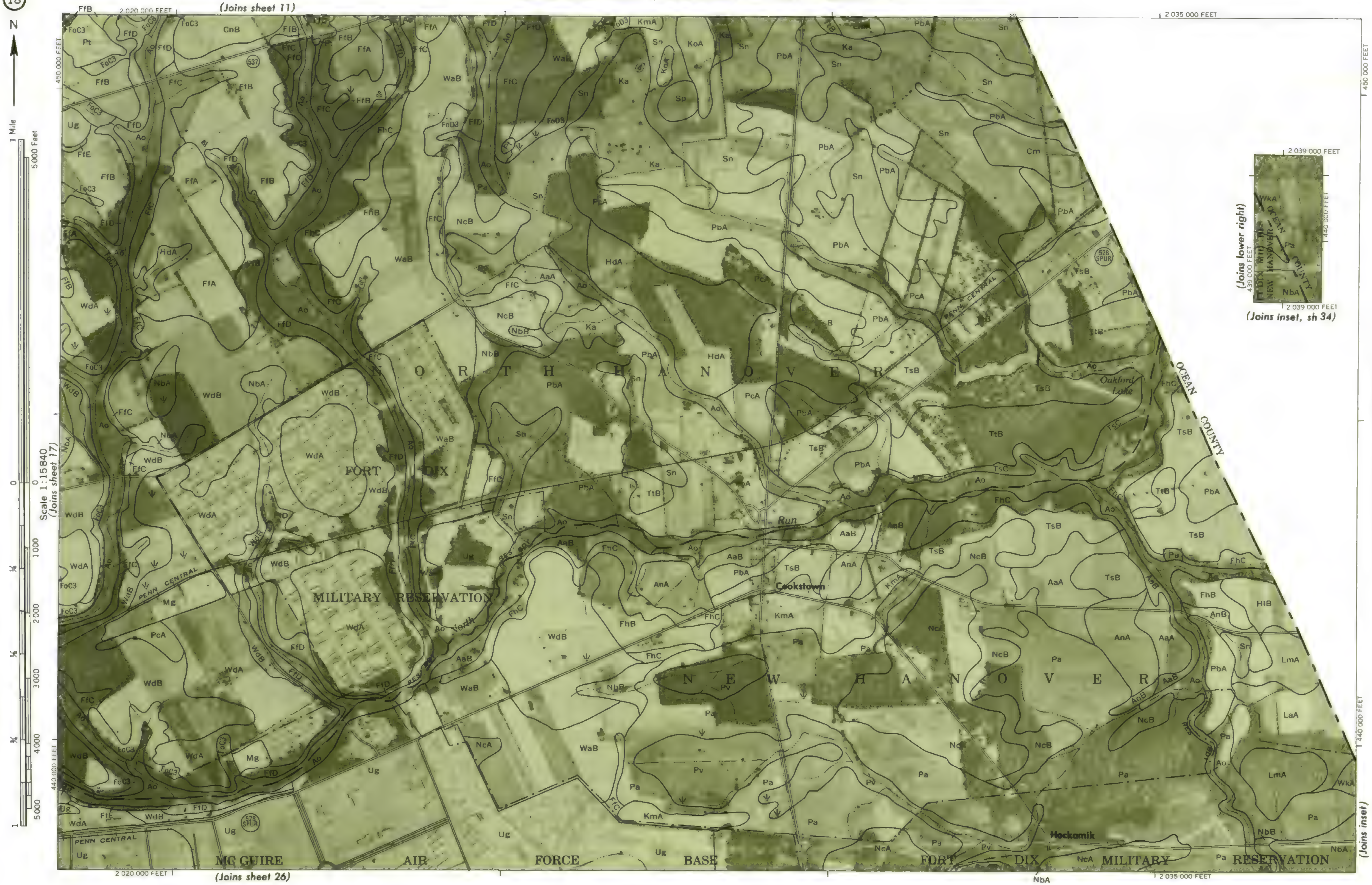
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 17



BURLINGTON COUNTY, NEW JERSEY NO. 18

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

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Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 19

N

1 Mile

5000 Feet

Scale 1:15 840

0 1000 2000 3000 4000 5000

BURLINGTON COUNTY, NEW JERSEY NO. 20

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

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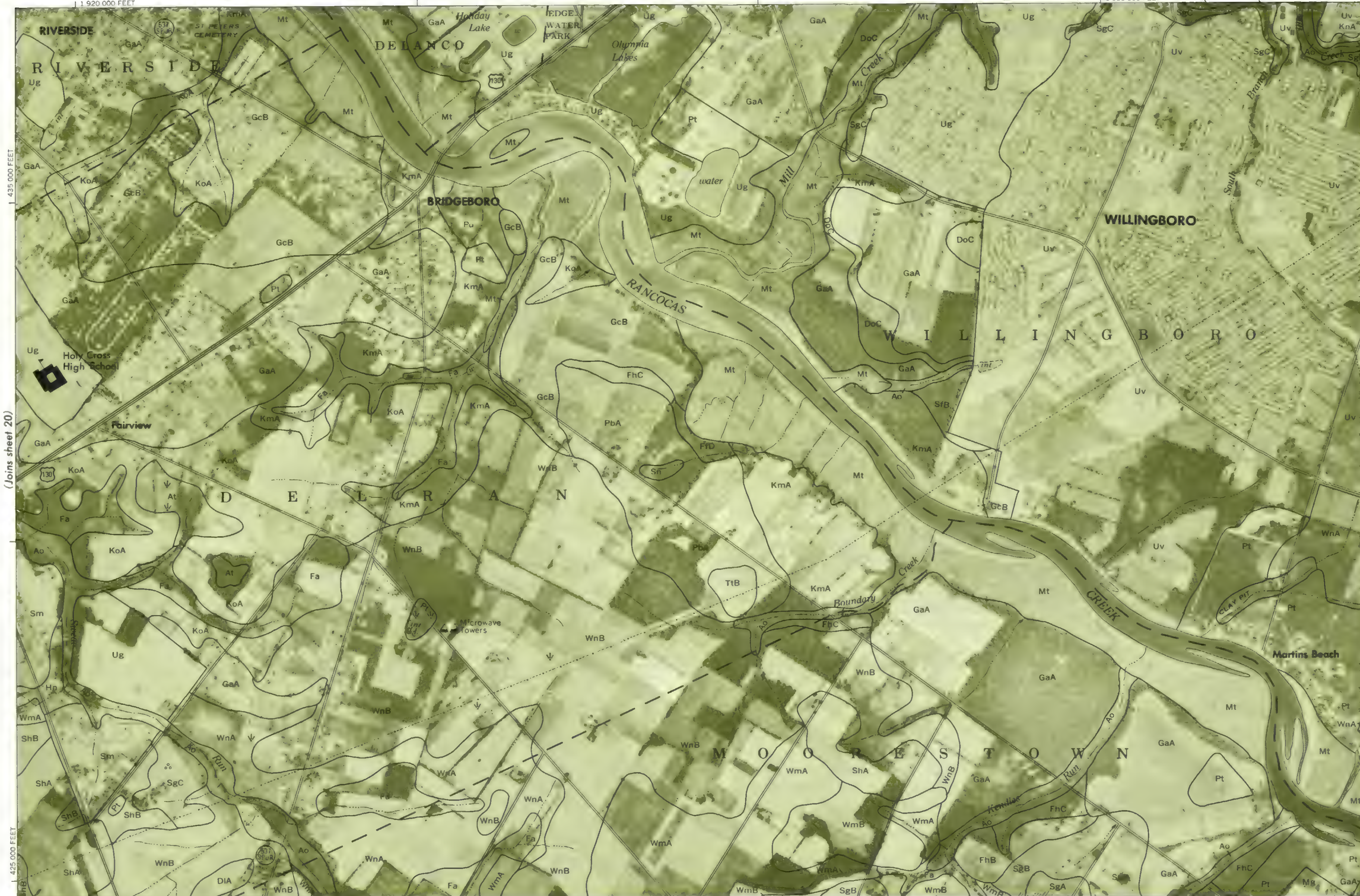

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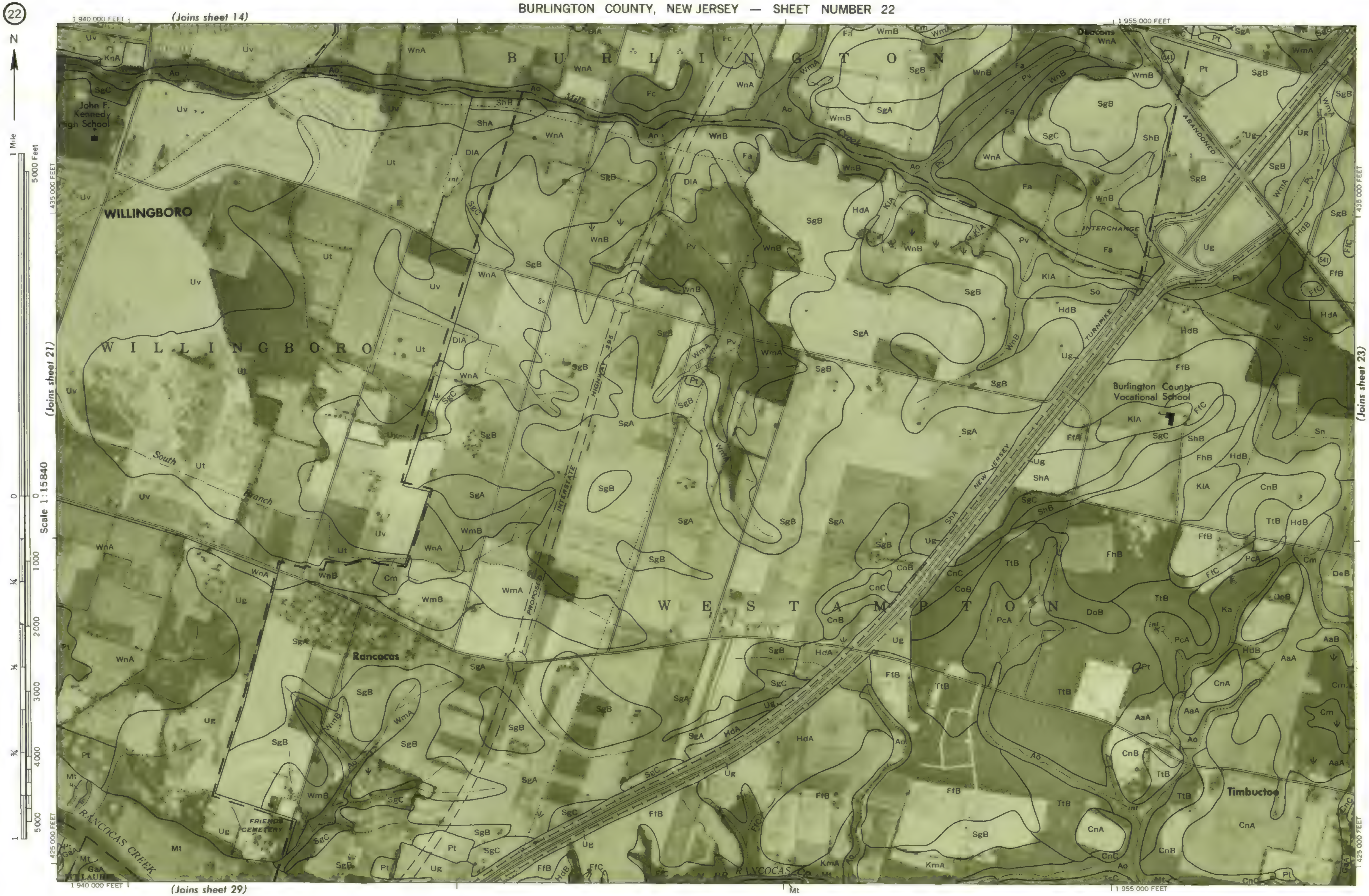
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 21

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 22



BURLINGTON COUNTY, NEW JERSEY NO. 22

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(23)

(Joins sheet 15)

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 30)

N

1 Mile

5 000 Feet

Scale 1:15840

0 1000 2000 3000 4000 5000

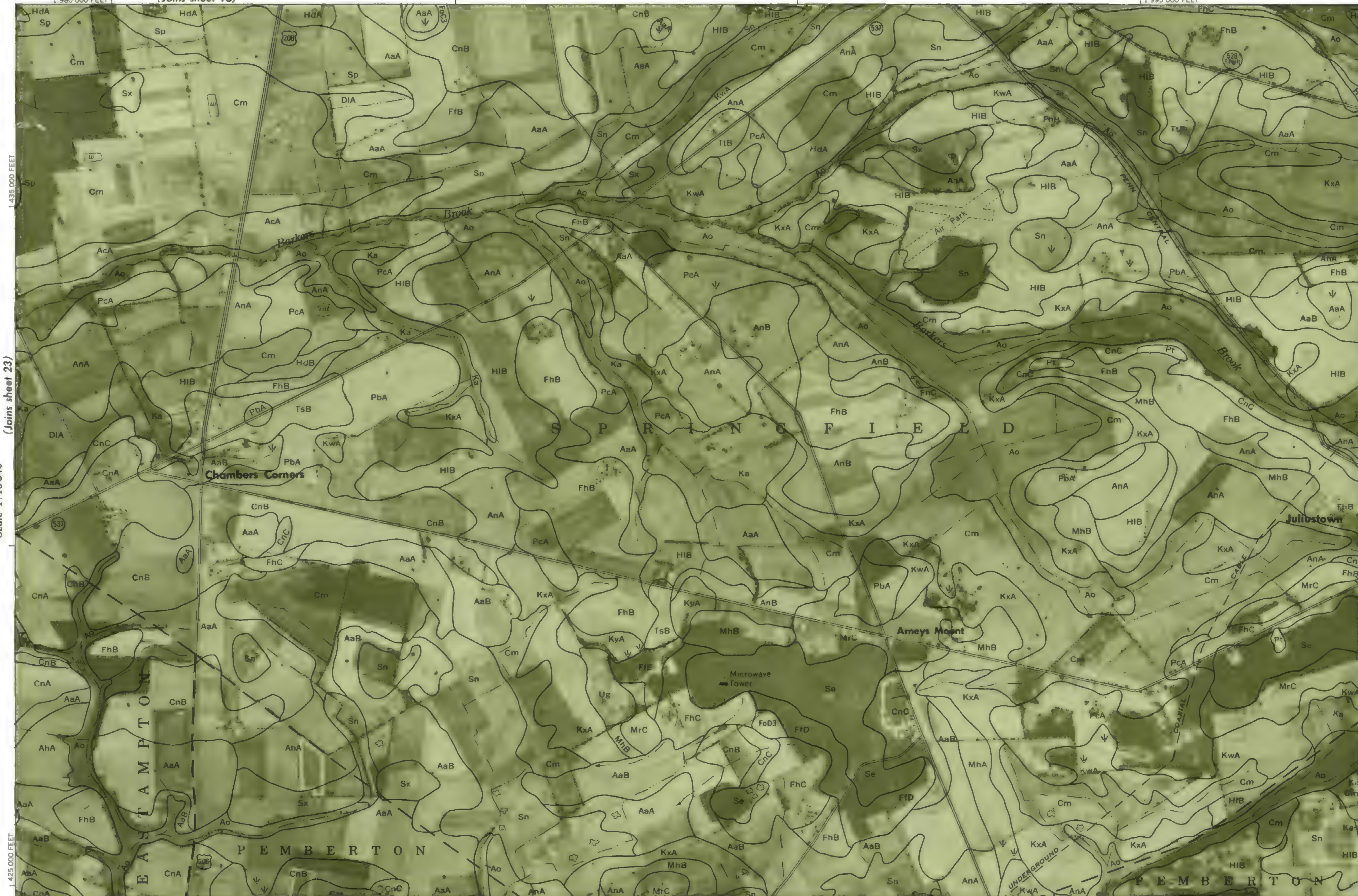
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 23

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 24

(Joins sheet 16)



N

Scale 1:15840

1 Mile

5000 Feet

(Joins sheet 23)

(Joins sheet 25)

(Joins sheet 31)

BURLINGTON COUNTY, NEW JERSEY NO. 24

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 25

(Joins sheet 17)

(Joins sheet 24)

(Joins sheet 26)

(Joins sheet 32)

N

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Scale 1:15840

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 26

N

Scale 1:15840

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

BURLINGTON COUNTY, NEW JERSEY NO. 26

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 27

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 27

(Joins sheet 21)

(Joins sheet 27)

(Joins sheet 29)

(Joins sheet 36)

N

Scale 1:15840

1 Mile

5000 Feet

BURLINGTON COUNTY, NEW JERSEY NO. 28

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(29)

(Joins sheet 22)

(Joins sheet 28)

(Joins sheet 30)

(Joins sheet 37)

N

1 Mile

5000 Feet

Scale 1:15840

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.

(Joins sheet 23)

1 960 000 FEET

1 975 000 FEET

N

1 Mile

5000 Feet

Scale 1:15840

0 1000 2000 3000 4000 5000

(Joins sheet 29)

(Joins sheet 31)

420 000 FEET

415 000 FEET

1 960 000 FEET

1 975 000 FEET

(Joins sheet 38)

BURLINGTON COUNTY, NEW JERSEY NO. 30

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 31

N

(Joins sheet 25)

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 40)

Scale 1:15 840

1 Mile

5000 Feet

BURLINGTON COUNTY, NEW JERSEY NO. 32

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 33

N

Scale 1:15840

1 Mile

5000 Feet

BURLINGTON COUNTY, NEW JERSEY NO. 34

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(Joins sheet 27)

(Joins sheet 36)

(Joins sheet 43)

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 35

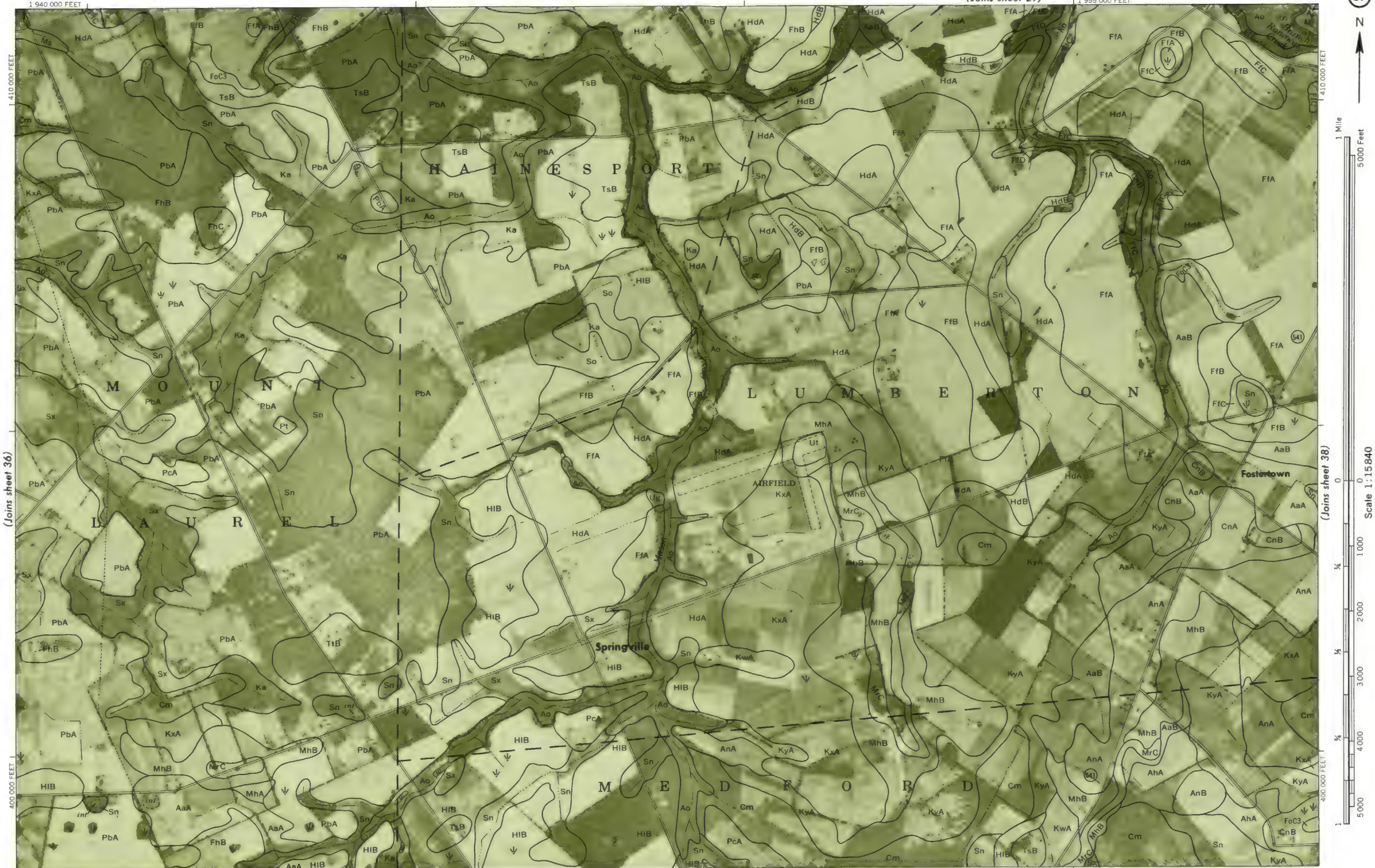
BURLINGTON COUNTY, NEW JERSEY NO. 36

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 37

(Joins sheet 29)



(Joins sheet 36)

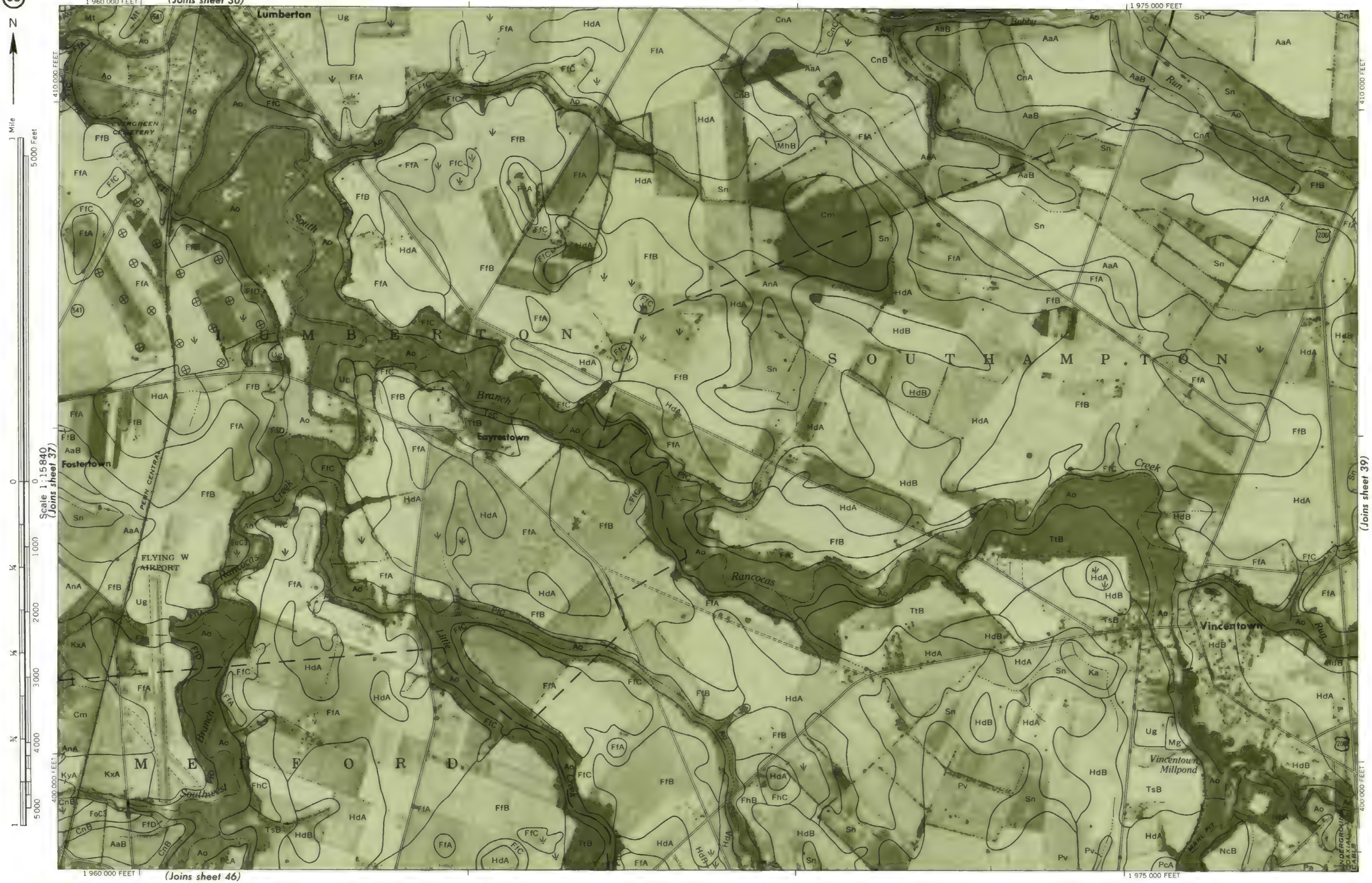
(Joins sheet 38)

(Joins sheet 45)

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 37

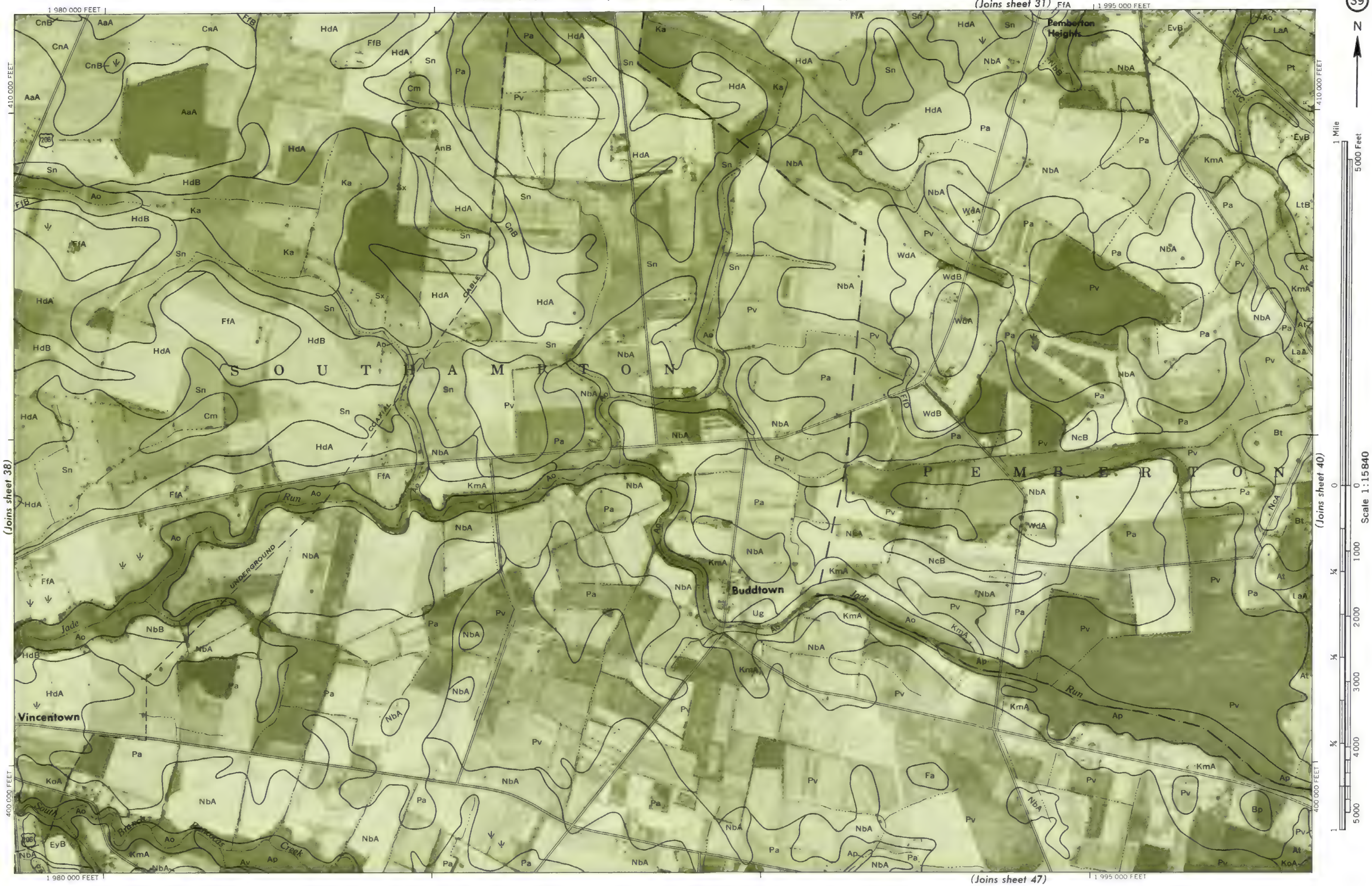
BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 38



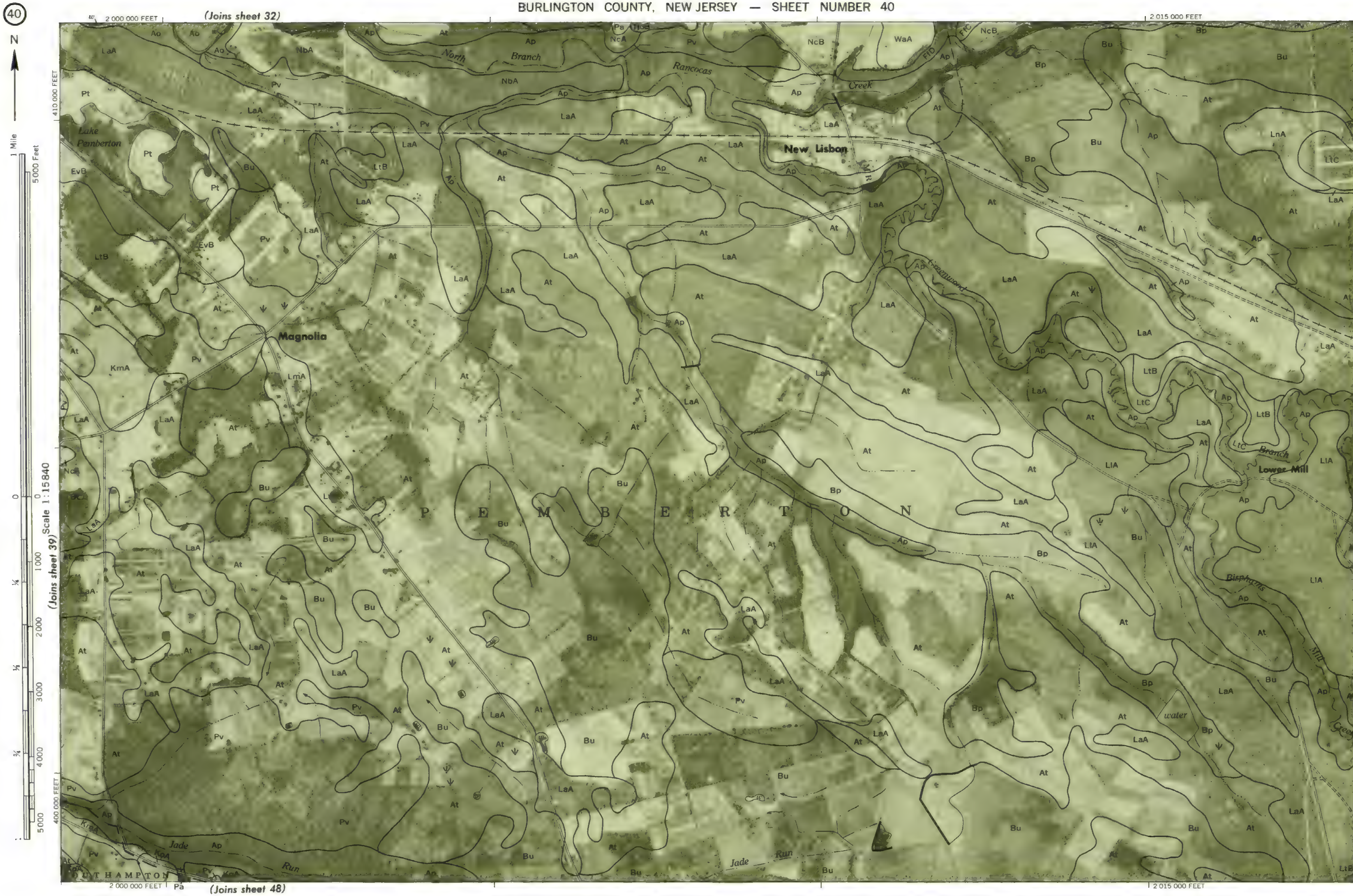
BURLINGTON COUNTY, NEW JERSEY NO. 38

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.



This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.
BURLINGTON COUNTY, NEW JERSEY NO. 39



BURLINGTON COUNTY, NEW JERSEY NO. 40

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(41)

(Joins sheet 33)

2 020 000 FEET

2 035 000 FEET

410 000 FEET

(Joins sheet 40)

(Joins sheet 42)

400 000 FEET

2 020 000 FEET

2 035 000 FEET

(Joins sheet 49)

N

Scale 1:15 840

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

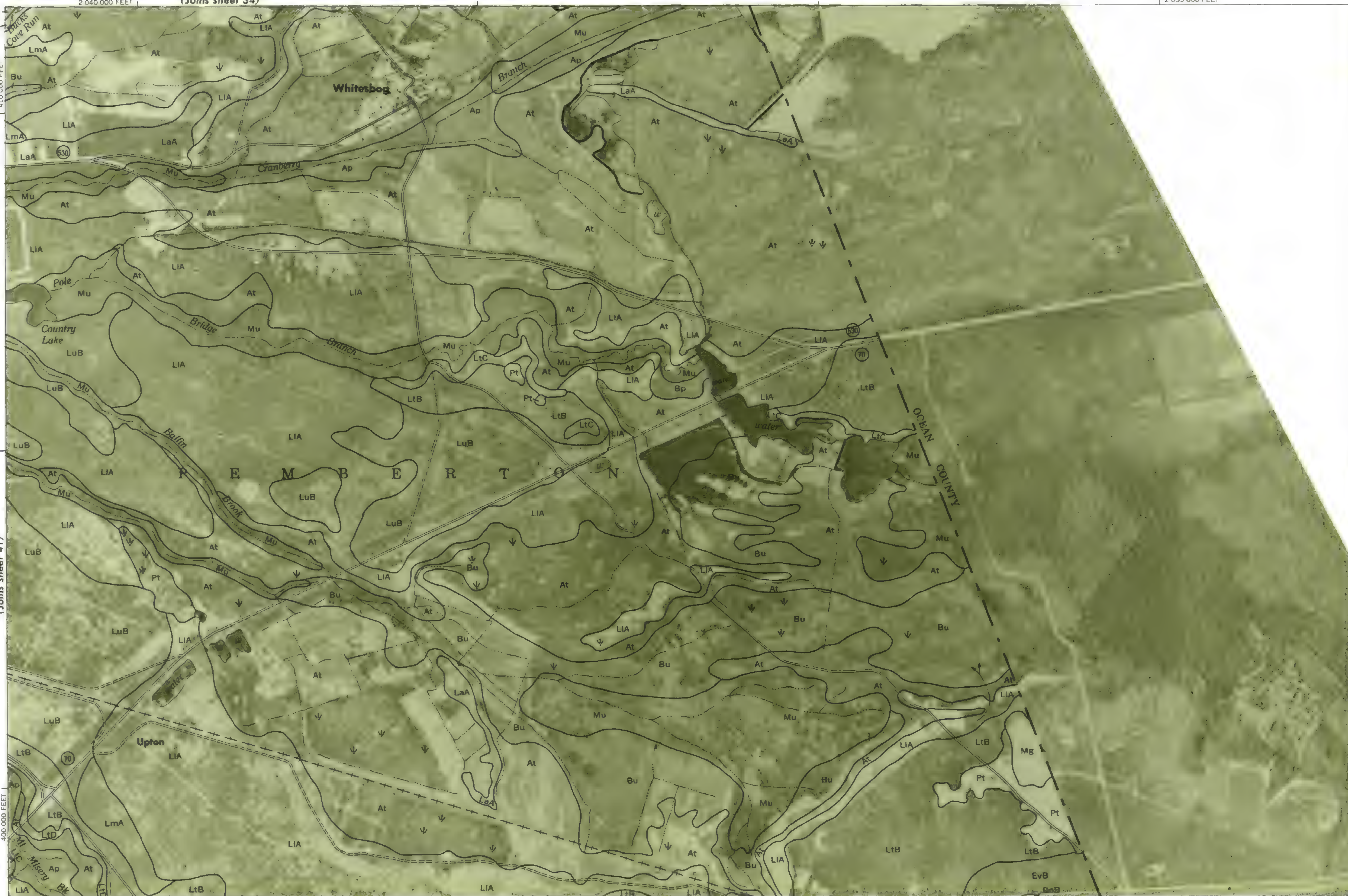
0 1000 2000 3000 4000 5000

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 41

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 42

(Joins sheet 34)



(Joins sheet 41)

(Joins sheet 50)

N

1 Mile

5000 Feet

Scale 1:15 840

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

BURLINGTON COUNTY, NEW JERSEY NO. 42

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

43

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 43

BURLINGTON COUNTY, NEW JERSEY NO. 44

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 45

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 46

(Joins sheet 38)

(Joins sheet 45)

(Joins sheet 47)

(Joins sheet 53)

N

1 Mile

5000 Feet

Scale 1:15840

0 ¼ ½ ¾ 1

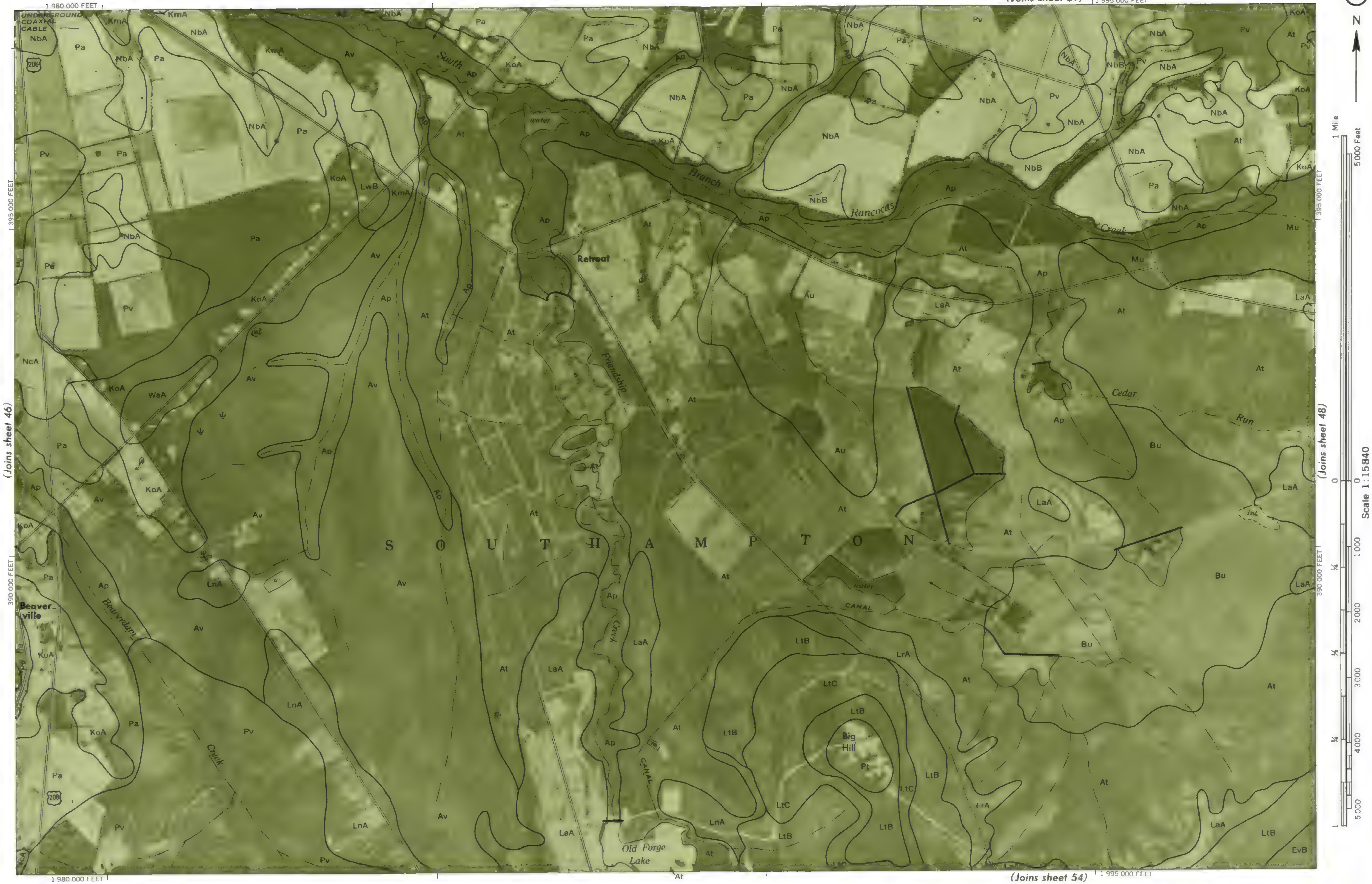
0 1000 2000 3000 4000 5000

BURLINGTON COUNTY, NEW JERSEY NO. 46

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 47



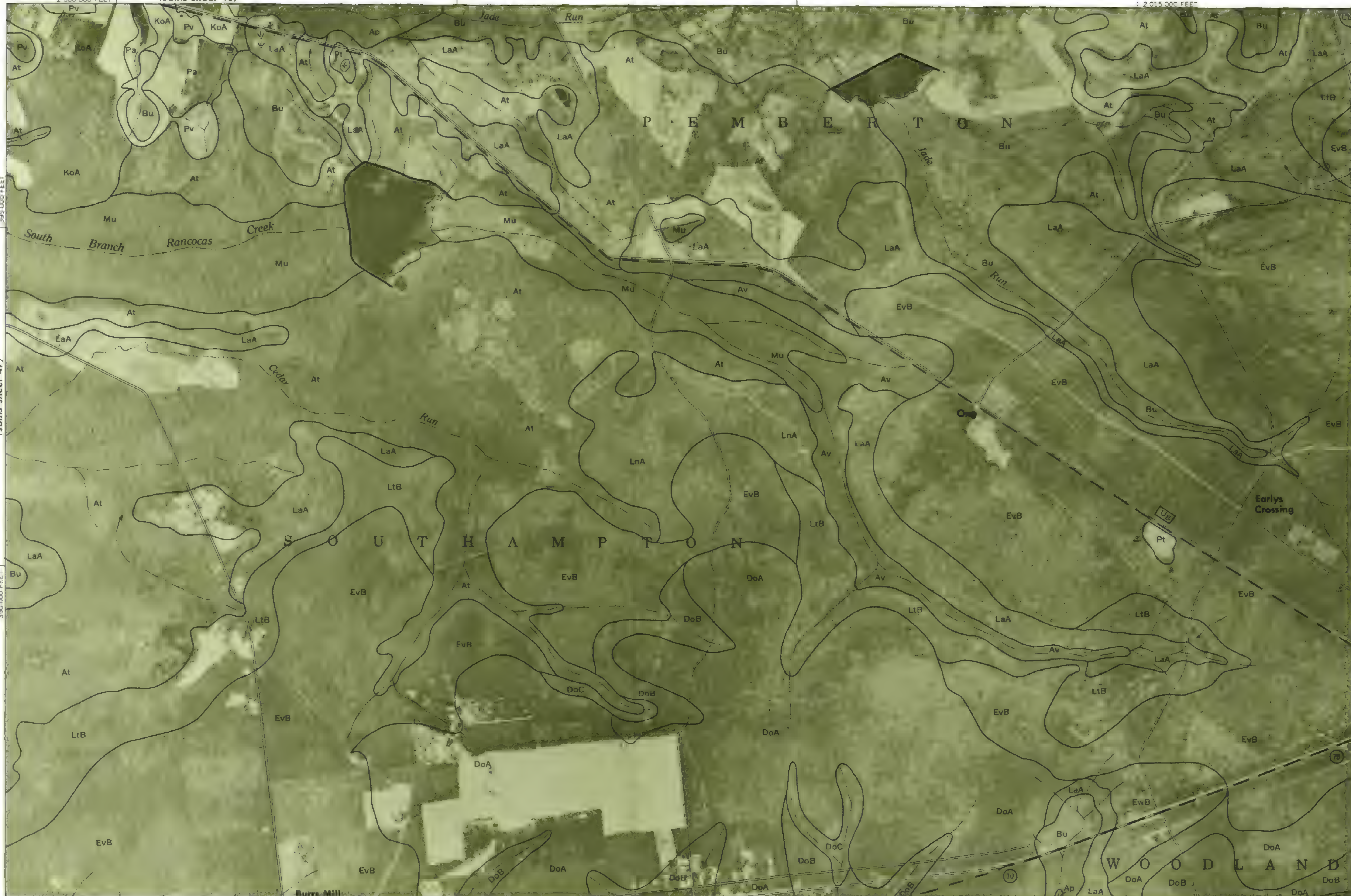
BURLINGTON COUNTY, NEW JERSEY NO. 47

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 48

(Joins sheet 40)

(Joins sheet 47)



(Joins sheet 49)

(Joins sheet 55)

N

1 Mile 0 ¼ ½ ¾ 1

5000 Feet 0 1000 2000 3000 4000 5000

Scale 1:15 840

BURLINGTON COUNTY, NEW JERSEY NO. 48

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(Joins sheet 41)

(Joins sheet 48)

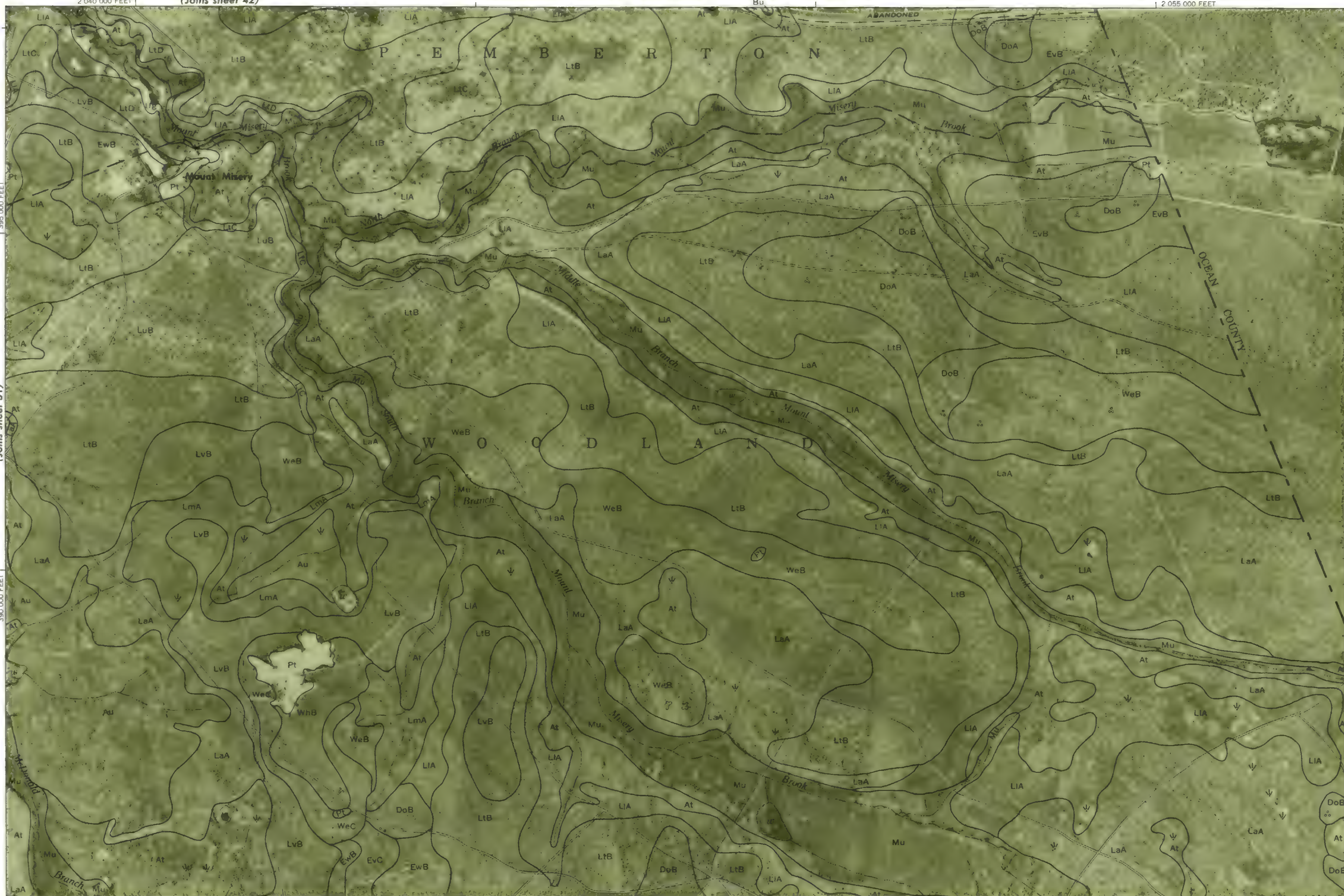
(Joins sheet 50)

(Joins sheet 56)

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 50

(Joins sheet 42)



N

Scale 1:15 840 (Joins sheet 51)

1 Mile ¾ ½ ¼ 0

5 000 Feet 4000 3000 2000 1000 0

(Joins sheet 57)

(Joins inset, sheet 58)

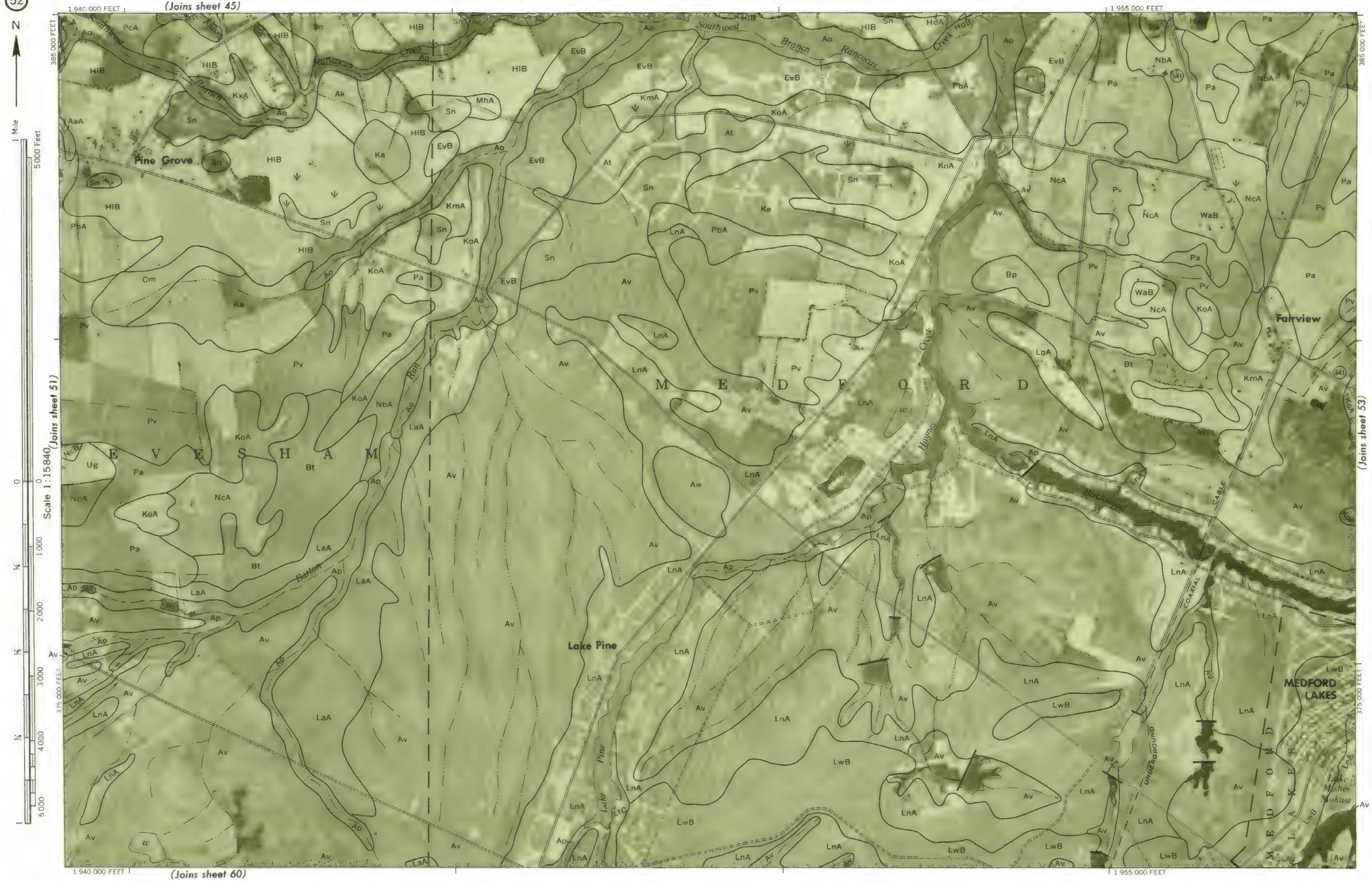
BURLINGTON COUNTY, NEW JERSEY NO. 50

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 51

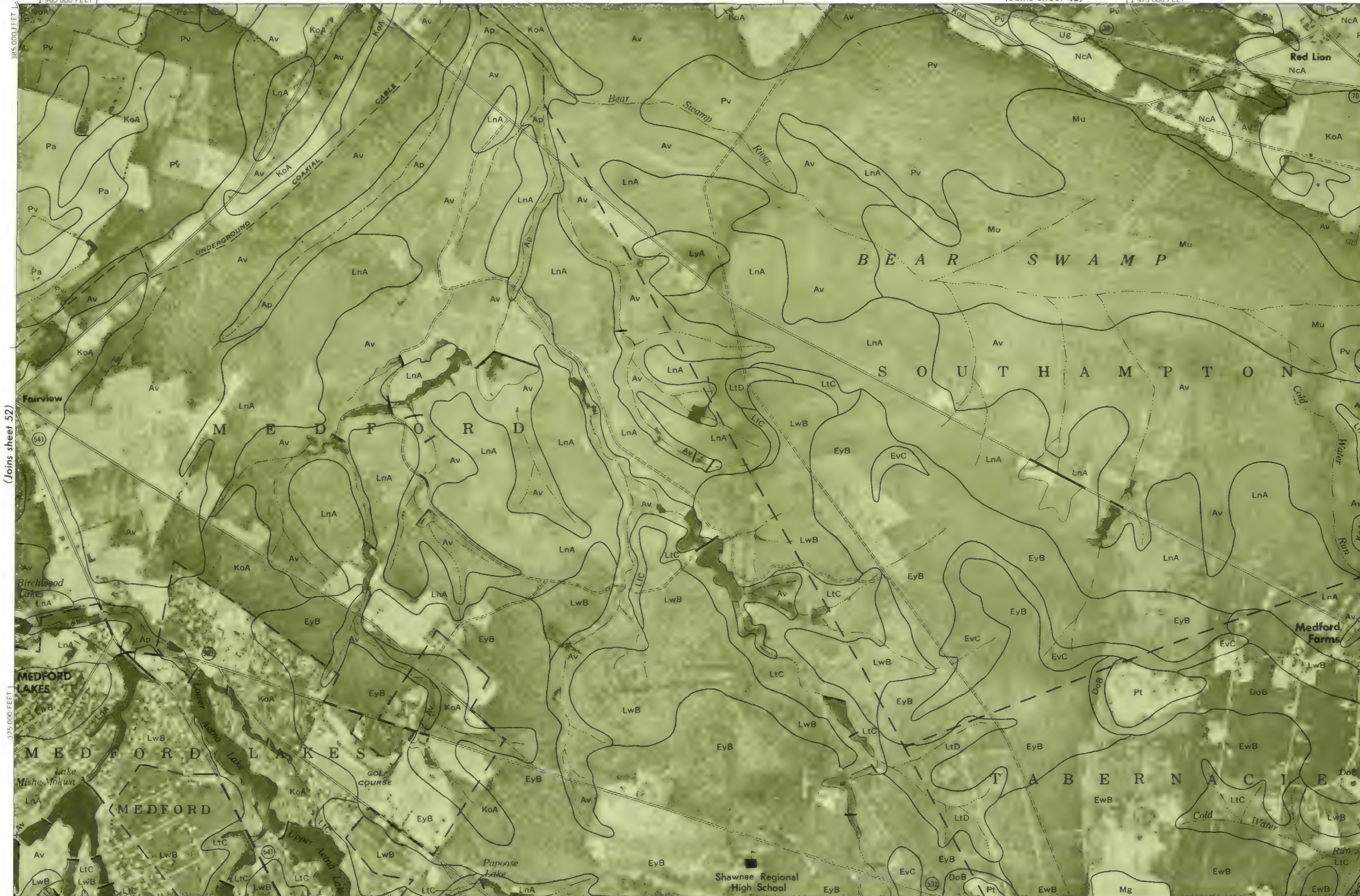


BURLINGTON COUNTY, NEW JERSEY NO. 52

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(Joins sheet 46)



(Joins sheet 52)

(Joins sheet 54)

(Joins sheet 61)

53

N

1 Mile

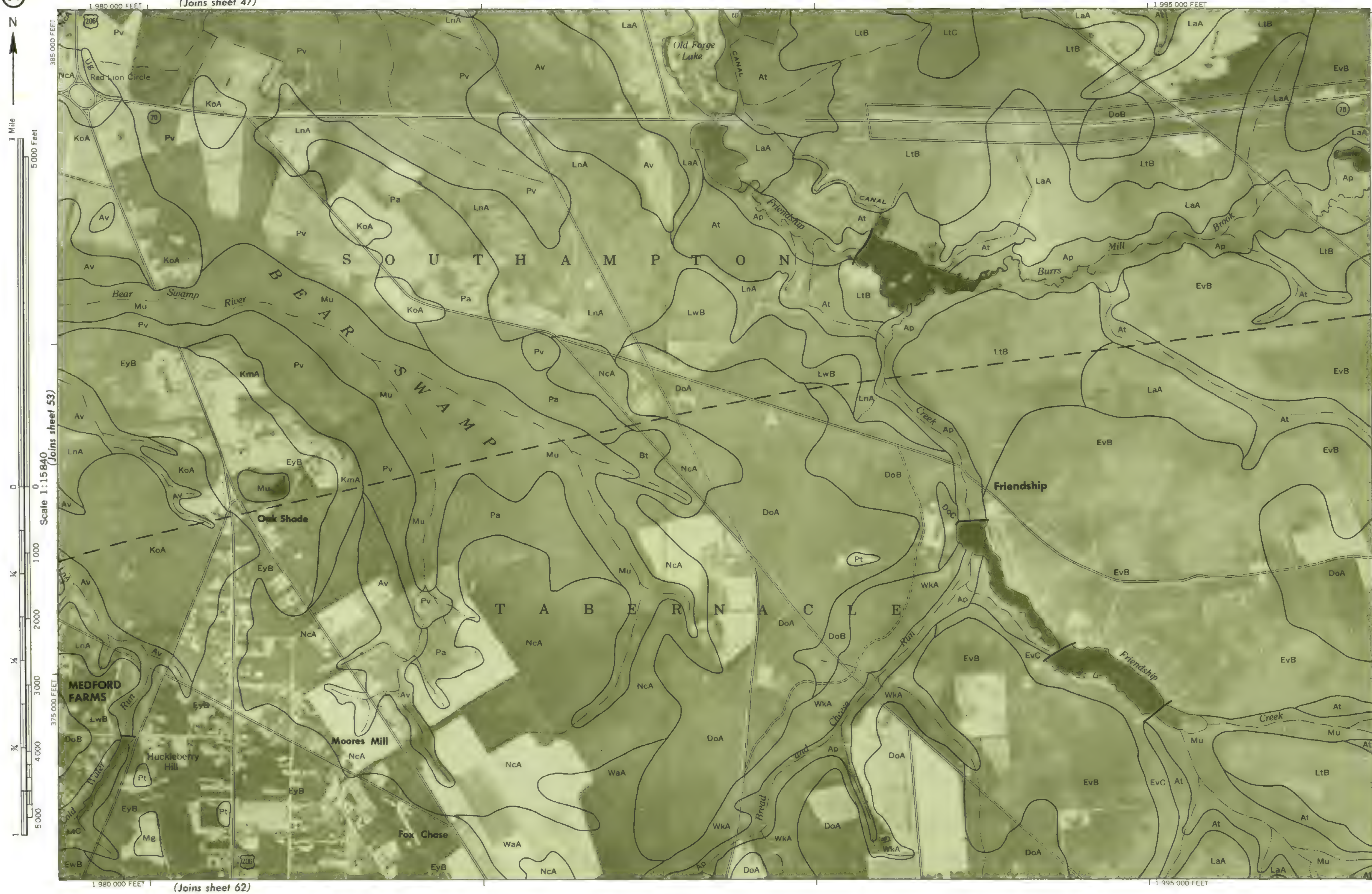
5000 Feet

Scale 1:15840

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

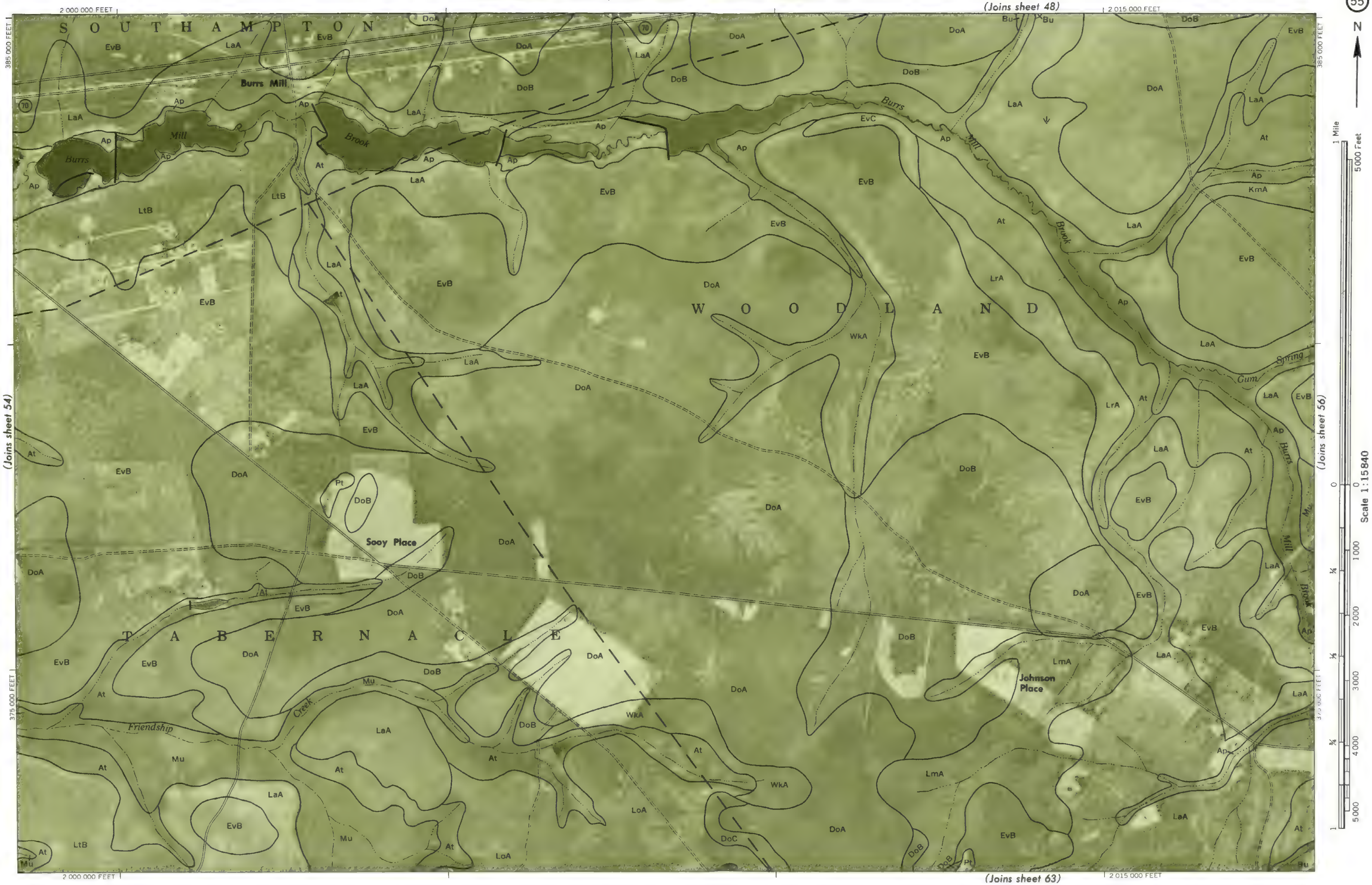
BURLINGTON COUNTY, NEW JERSEY NO. 53



BURLINGTON COUNTY, NEW JERSEY NO. 54

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

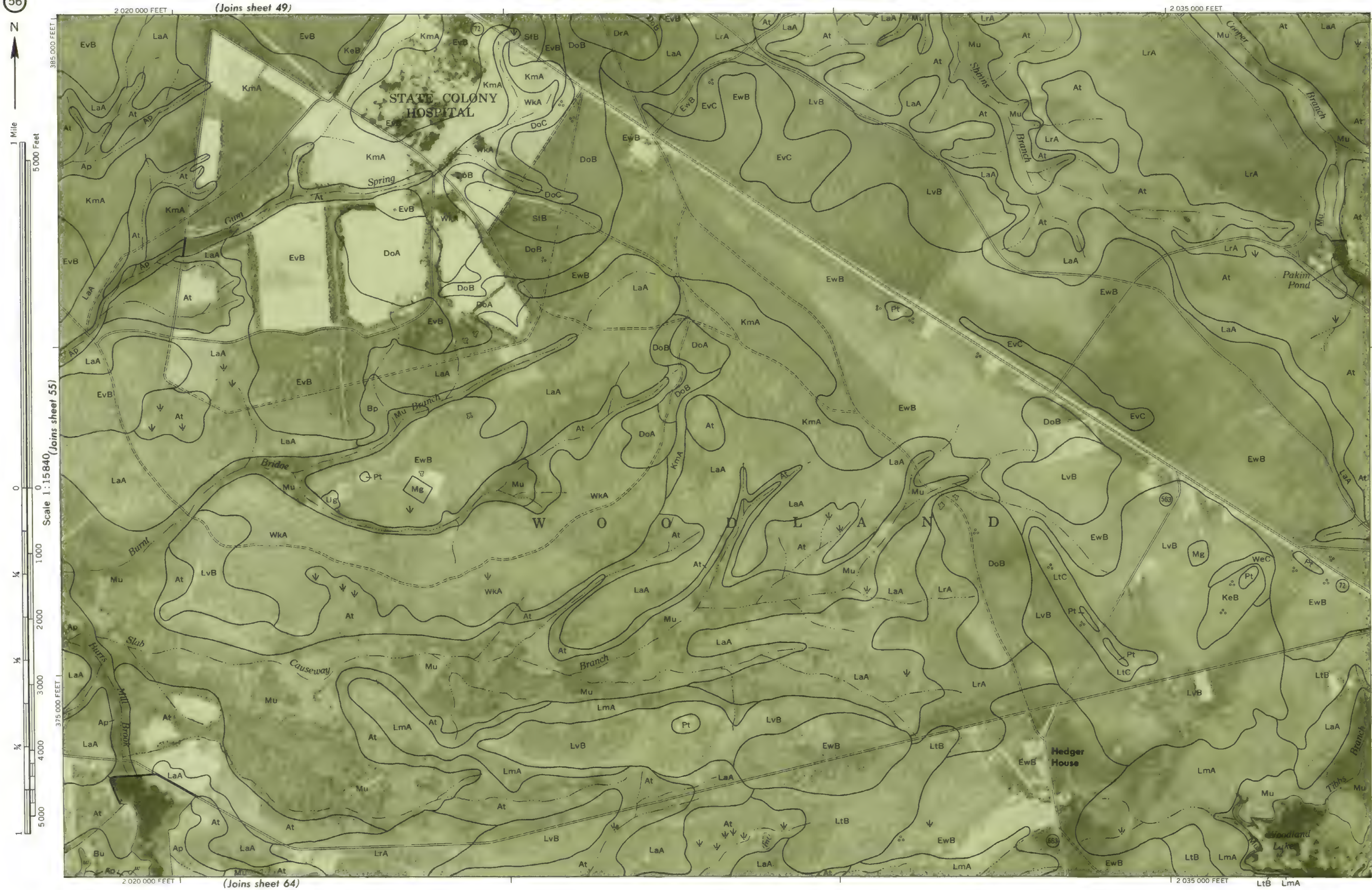
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.



BURLINGTON COUNTY, NEW JERSEY NO. 55

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 56

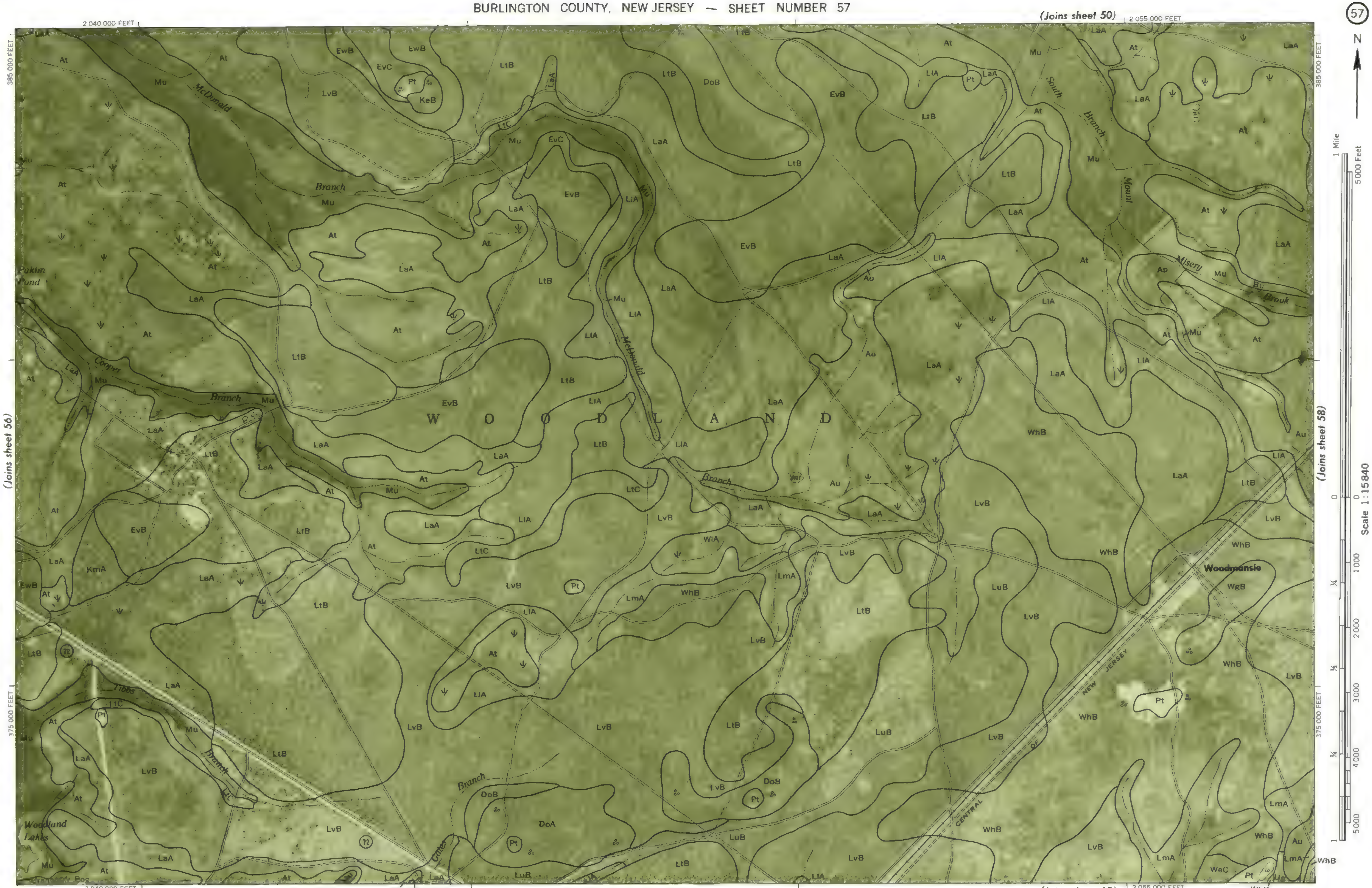


BURLINGTON COUNTY, NEW JERSEY NO. 56

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

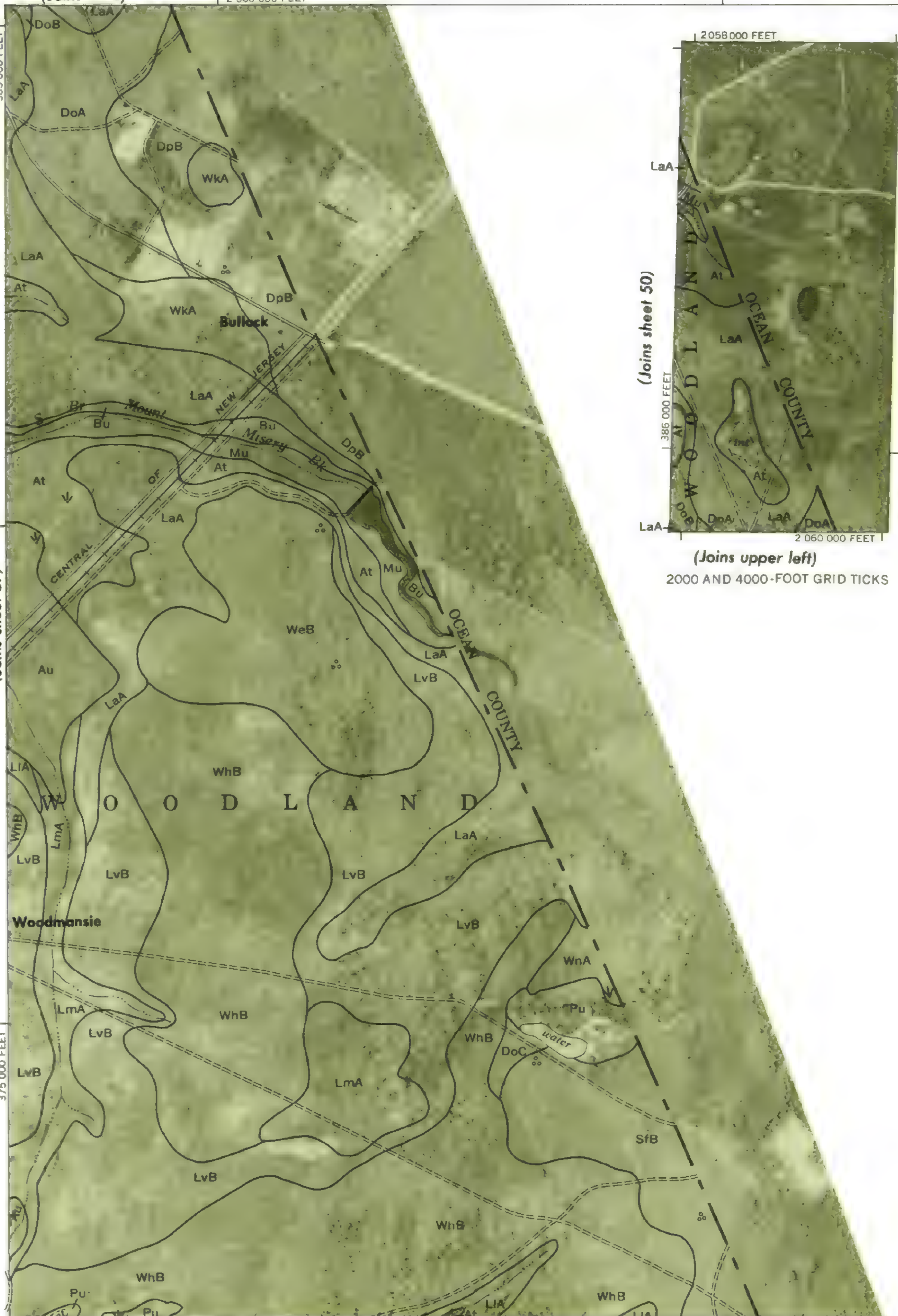
BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 57



BURLINGTON COUNTY, NEW JERSEY NO. 57

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.

(Joins inset)



(Joins sheet 57)

(Joins sheet 66)

(Joins sheet 50)

(Joins upper left)

2000 AND 4000-FOOT GRID TICKS

N

Scale 1:15 840

1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1

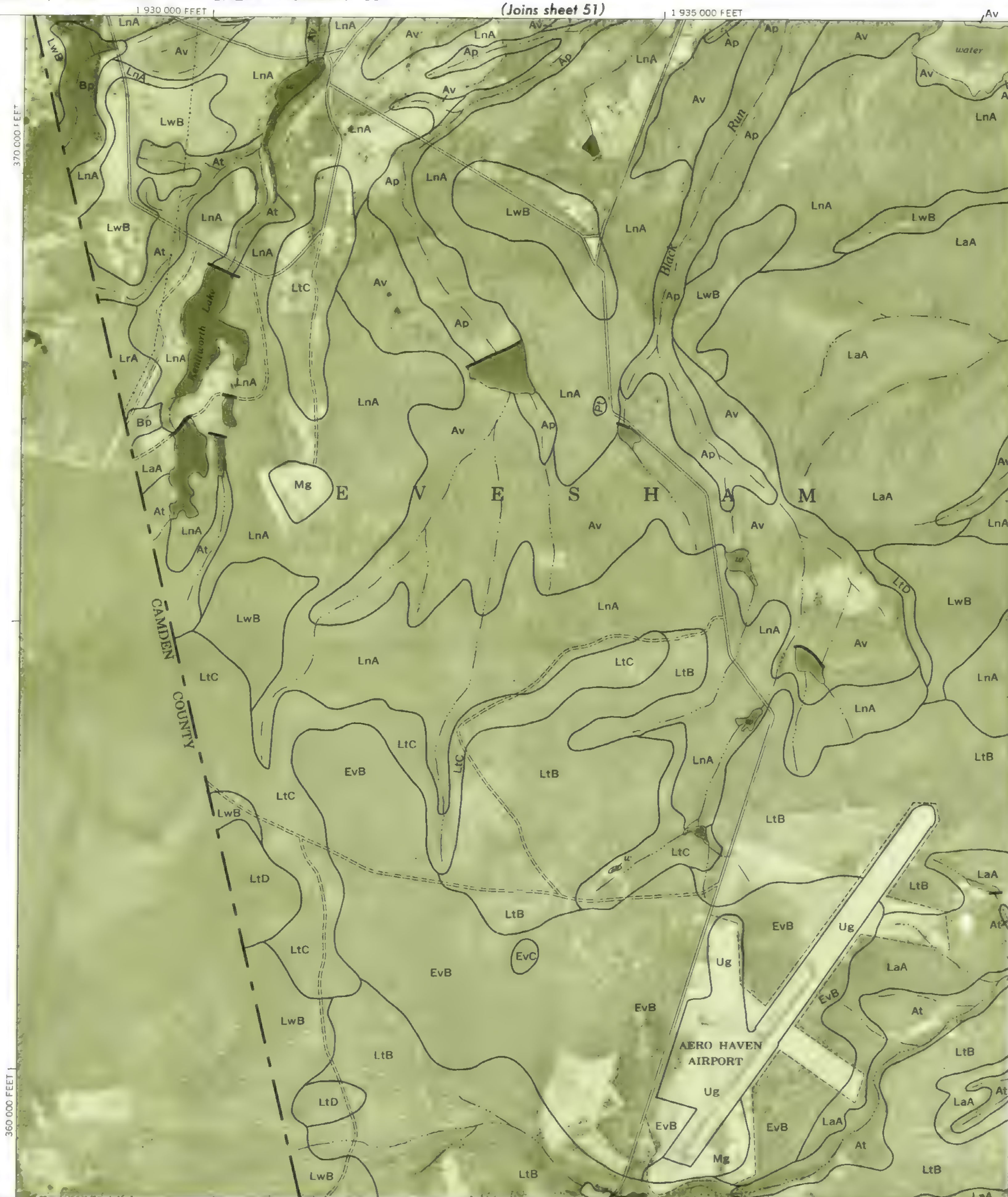
BURLINGTON COUNTY, NEW JERSEY NO. 58

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 59

59



N

1 Mile

5000 Feet

Scale 1:15 840

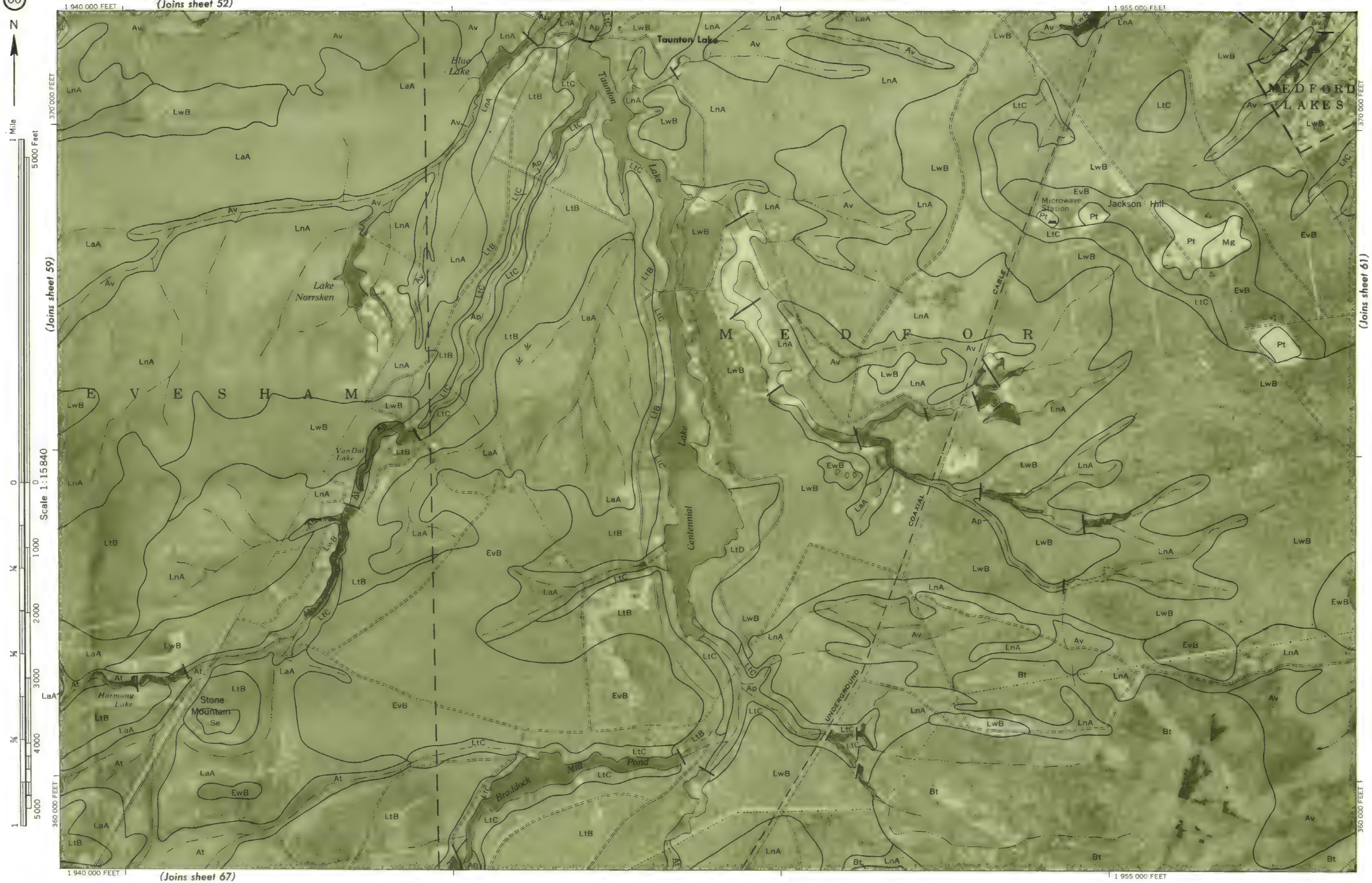
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 59

(60)

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 60

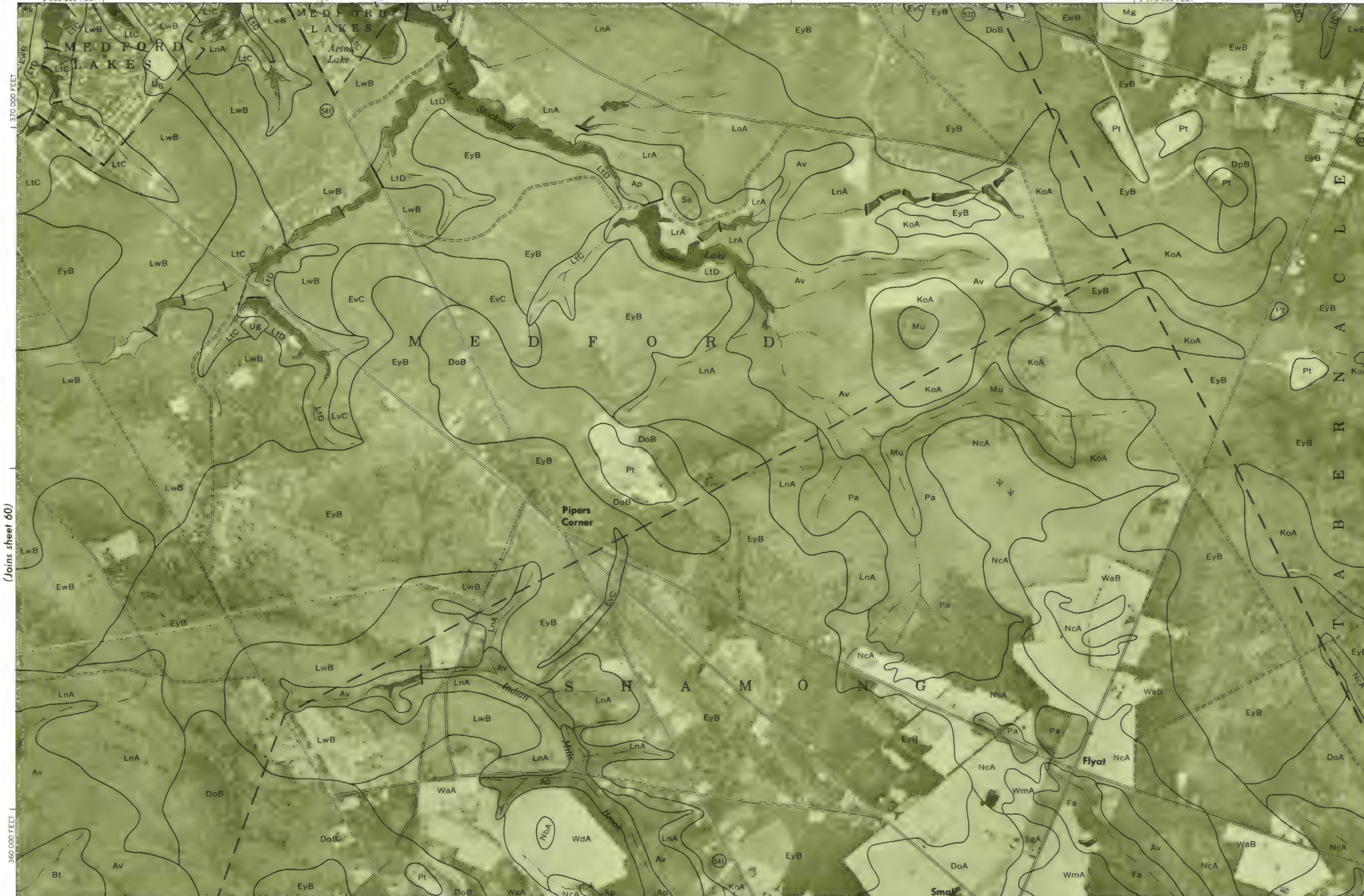


BURLINGTON COUNTY, NEW JERSEY NO. 60

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(Joins sheet 53)



N

1 Mile
5000 Feet
Scale 1:15840
0 1000 2000 3000 4000 5000

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 61

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 62

BURLINGTON COUNTY, NEW JERSEY NO. 62

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station

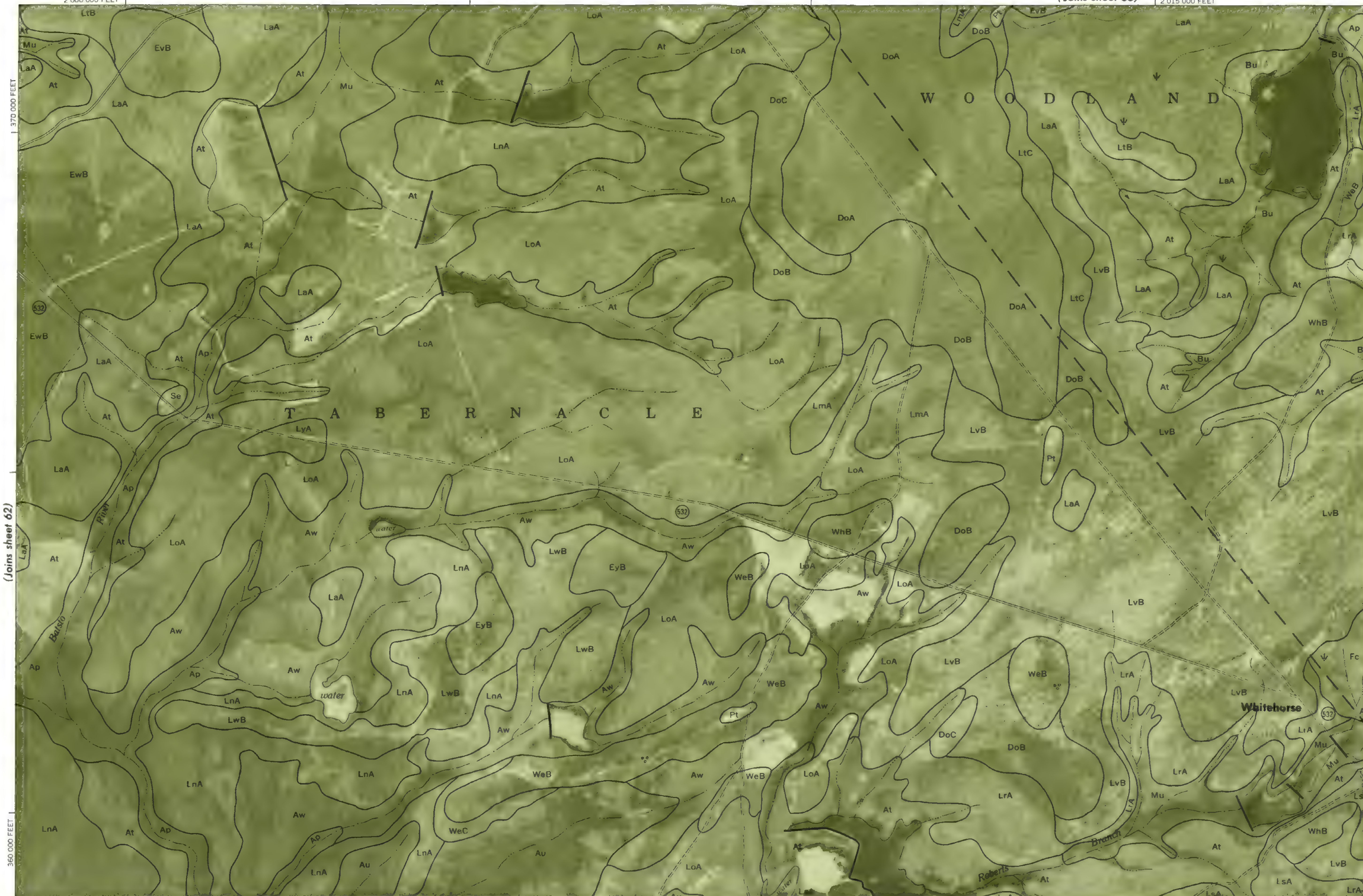
63

(Joins sheet 55)

2 000 000 FEET

2 015 000 FEET

370 000 FEET



(Joins sheet 62)

(Joins sheet 64)

(Joins sheet 70)

360 000 FEET

2 000 000 FEET

2 015 000 FEET

N

1 Mile

5 000 Feet

Scale 1:15840

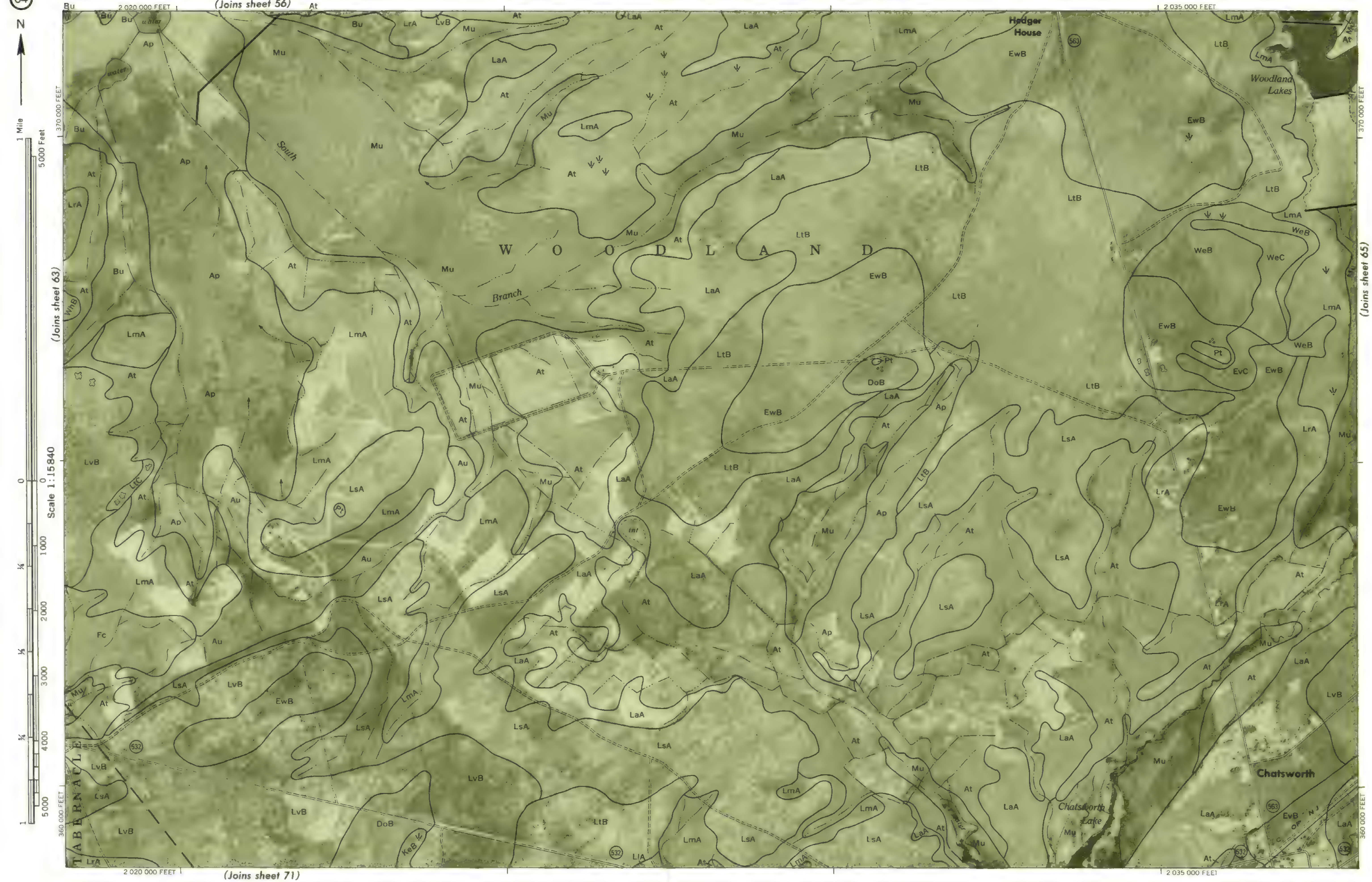
0 1000 2000 3000 4000 5000

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 63

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 64



BURLINGTON COUNTY, NEW JERSEY NO. 64

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 65

65

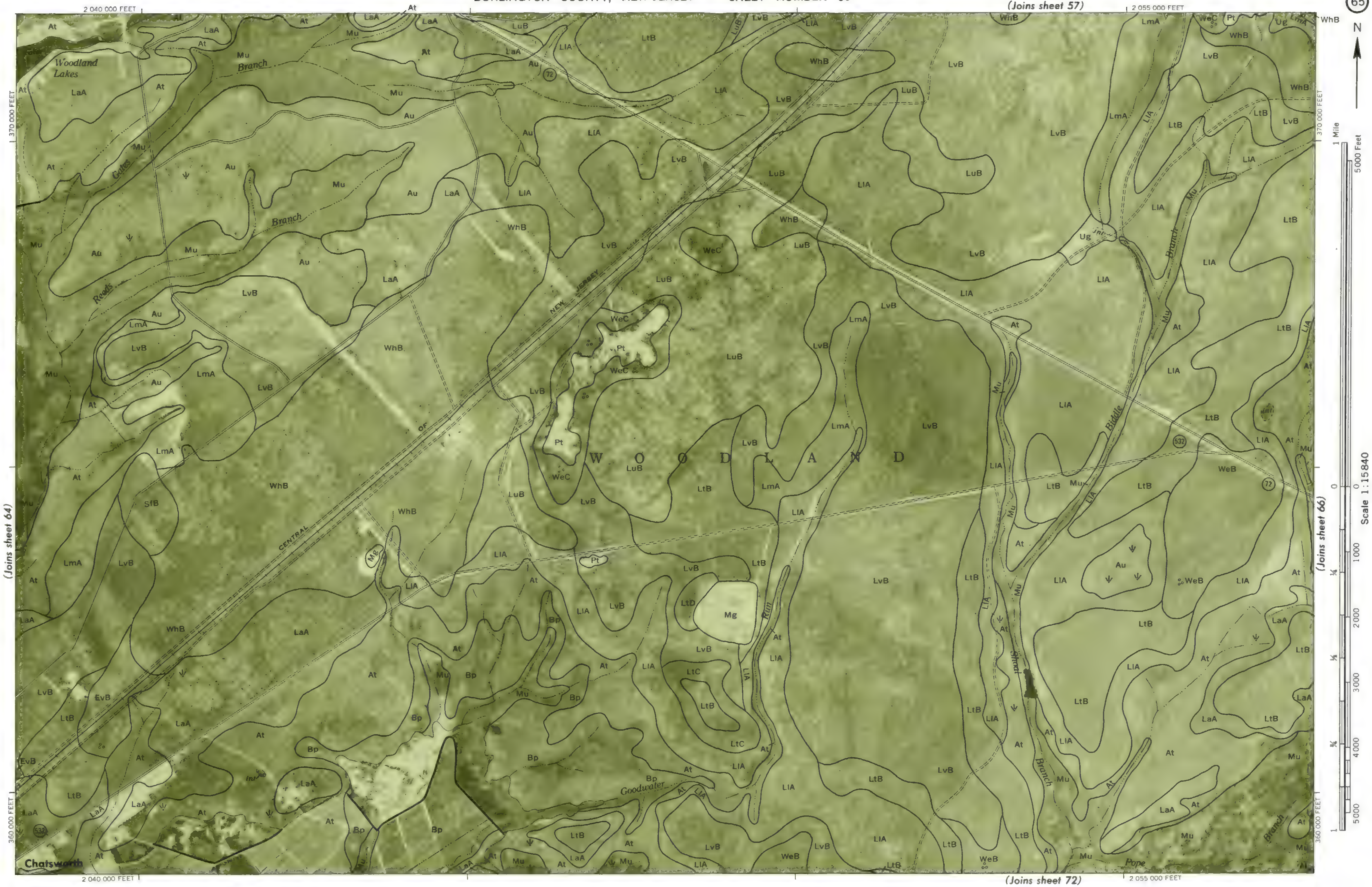
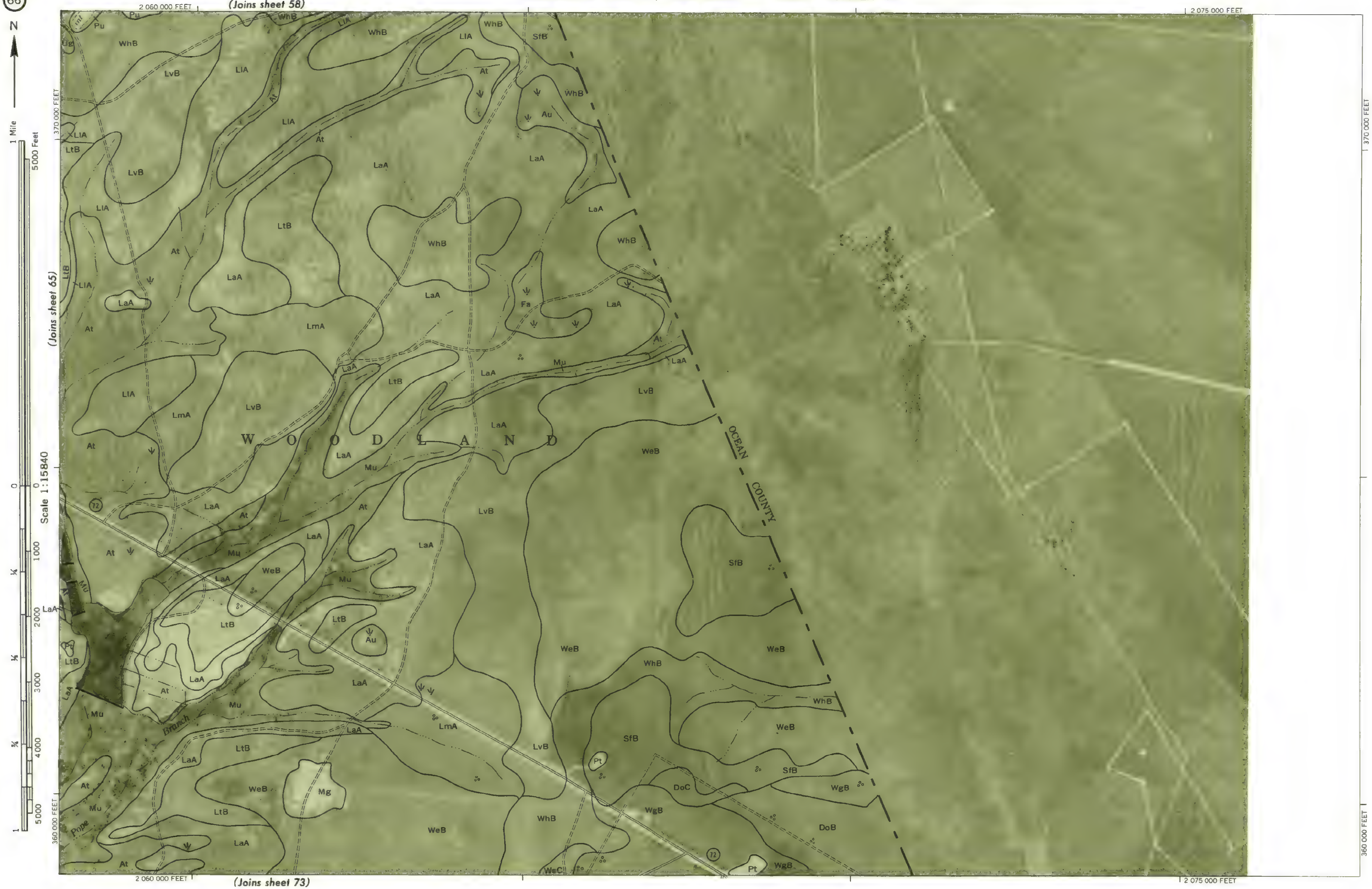


Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

BURLINGTON COUNTY, NEW JERSEY NO. 65

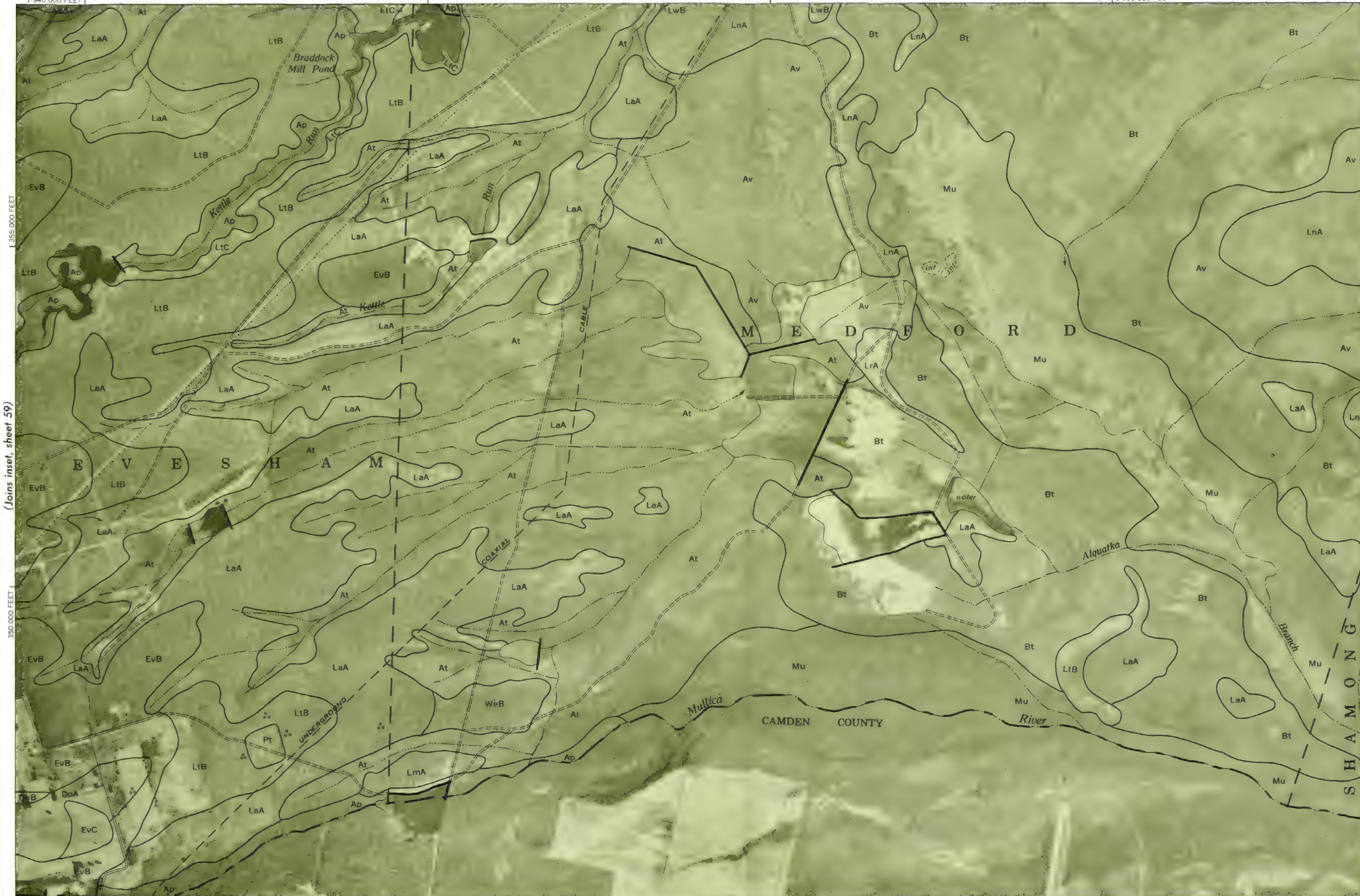


BURLINGTON COUNTY, NEW JERSEY NO. 66

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(Joins sheet 60)



(Joins inset, sheet 59)

(Joins sheet 68)

N

Scale 1:15840

1 Mile ¾ ½ ¼ 0

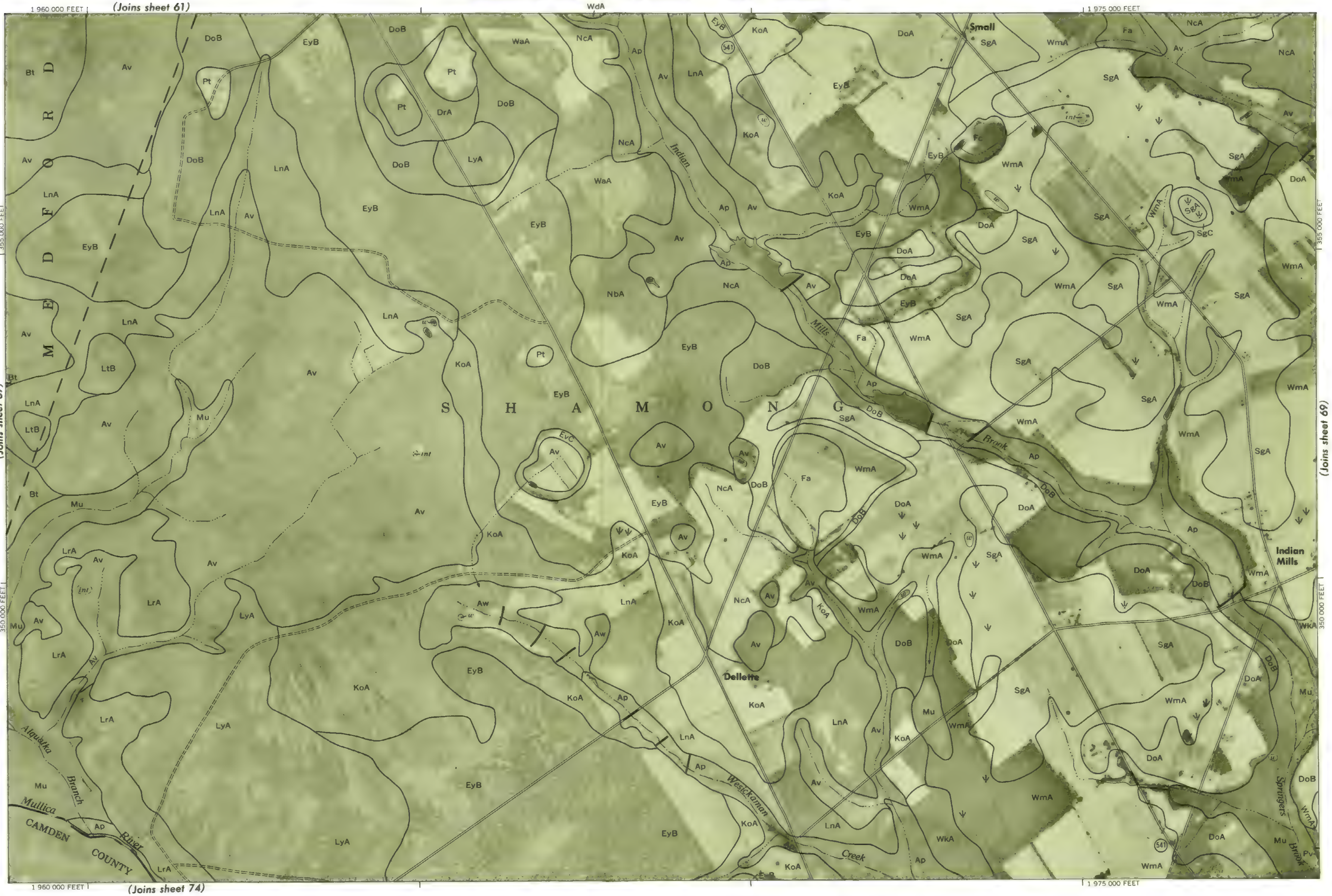
5000 Feet 4000 3000 2000 1000 0

BURLINGTON COUNTY, NEW JERSEY NO. 67

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

N



Scale 1:15840

1 Mile

5000 Feet

BURLINGTON COUNTY, NEW JERSEY NO. 68

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 69

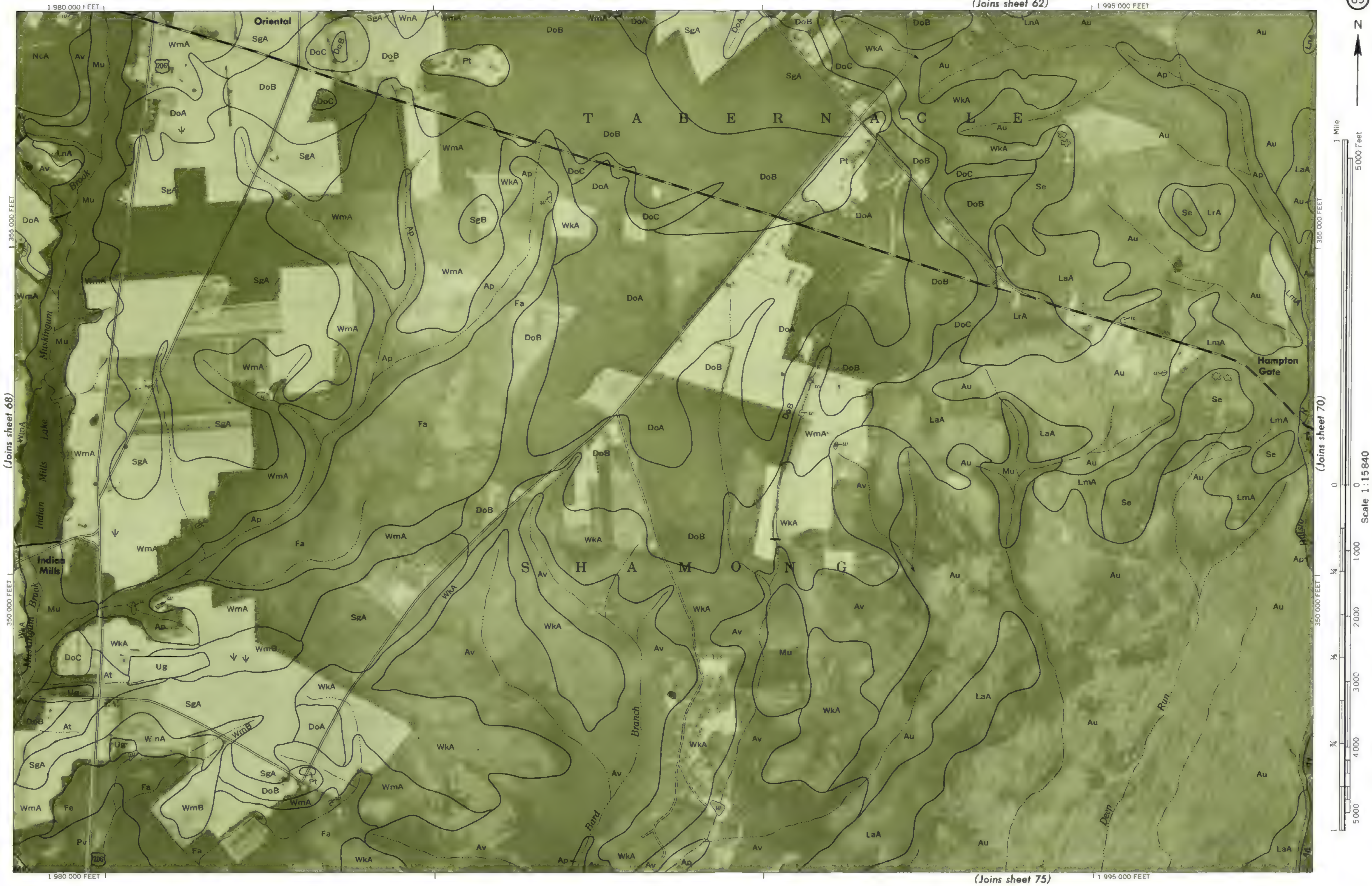


Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

BURLINGTON COUNTY, NEW JERSEY NO. 69

(70)

N

1 Mile

5 000 Feet

Scale 1:15840

(Joins sheet 63)

(Joins sheet 76)

BURLINGTON COUNTY, NEW JERSEY NO. 70

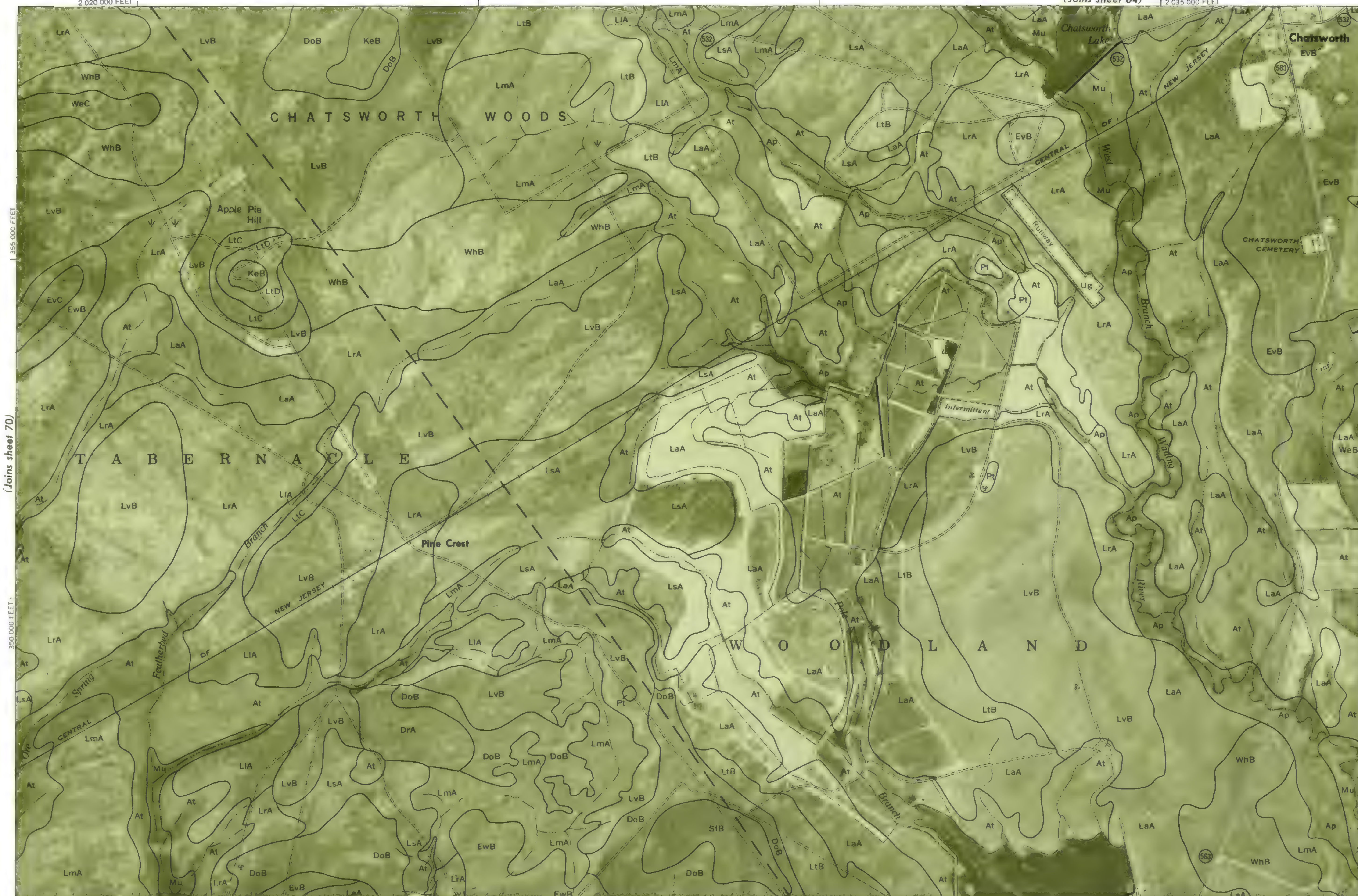
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 71

(71)

(Joins sheet 64)



(Joins sheet 70)

(Joins sheet 72)

(Joins sheet 77)

N

1 Mile
5000 Feet
Scale 1:15840
0
¼
½
¾
1000
2000
3000
4000
5000

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.

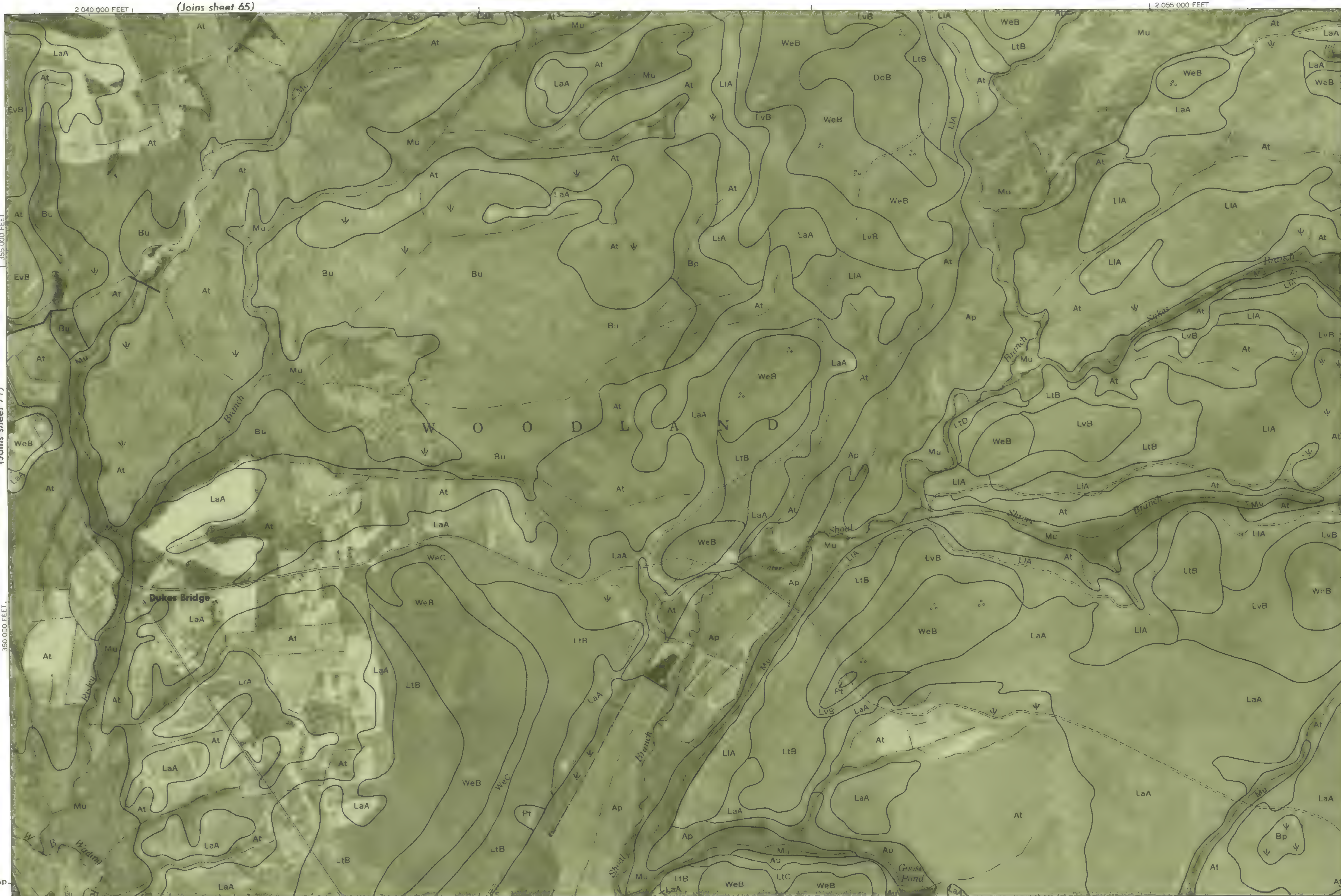
BURLINGTON COUNTY, NEW JERSEY NO. 71

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 72

N

(Joins sheet 65)

(Joins sheet 71)



(Joins sheet 73)

(Joins sheet 78)

Scale 1:15840

1 Mile | 5 000 Feet | 0 | 1000 | 2000 | 3000 | 4000 | 5000 | 0 | ¼ | ½ | ¾ | 1

BURLINGTON COUNTY, NEW JERSEY NO. 72

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 73

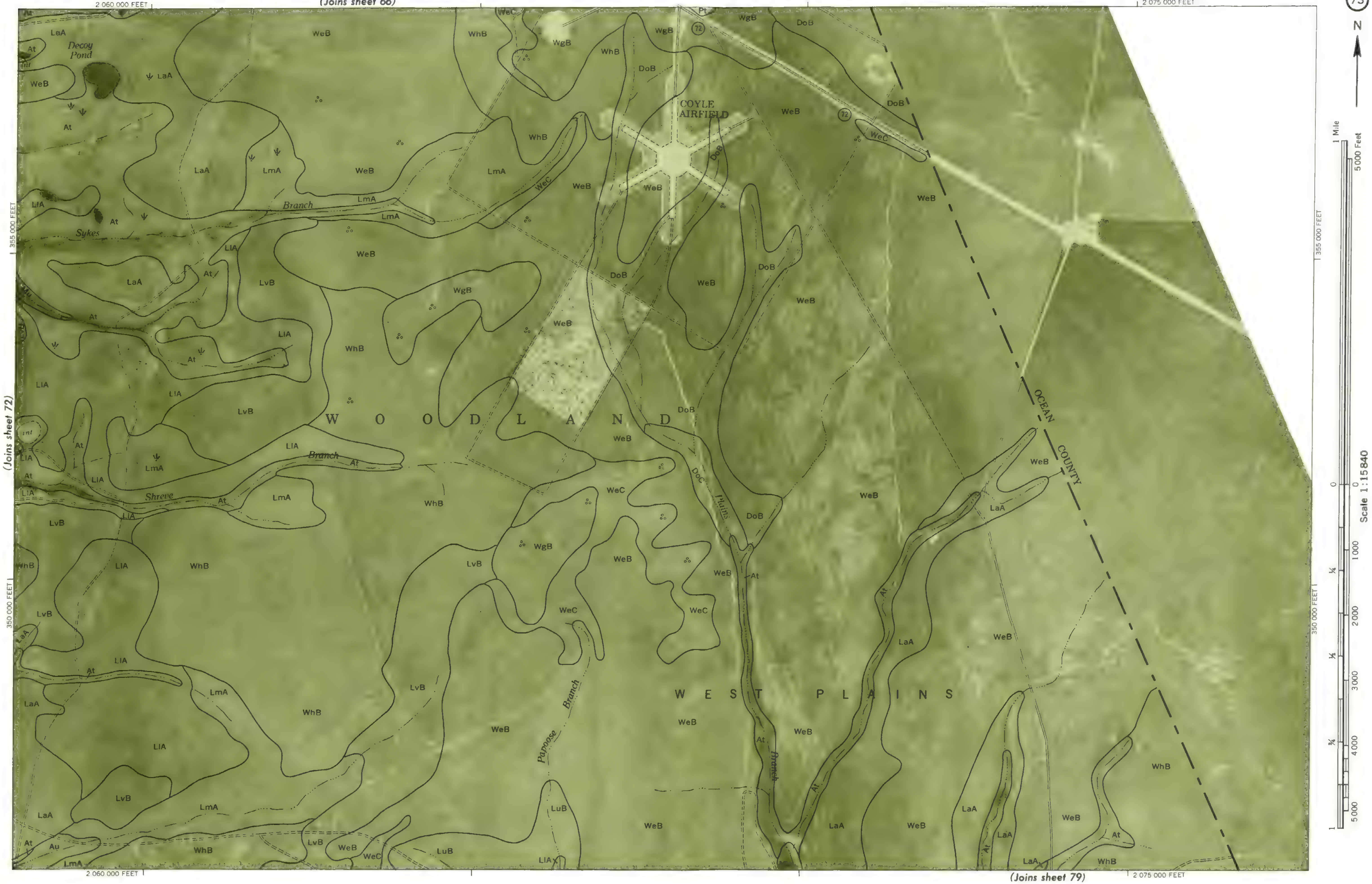
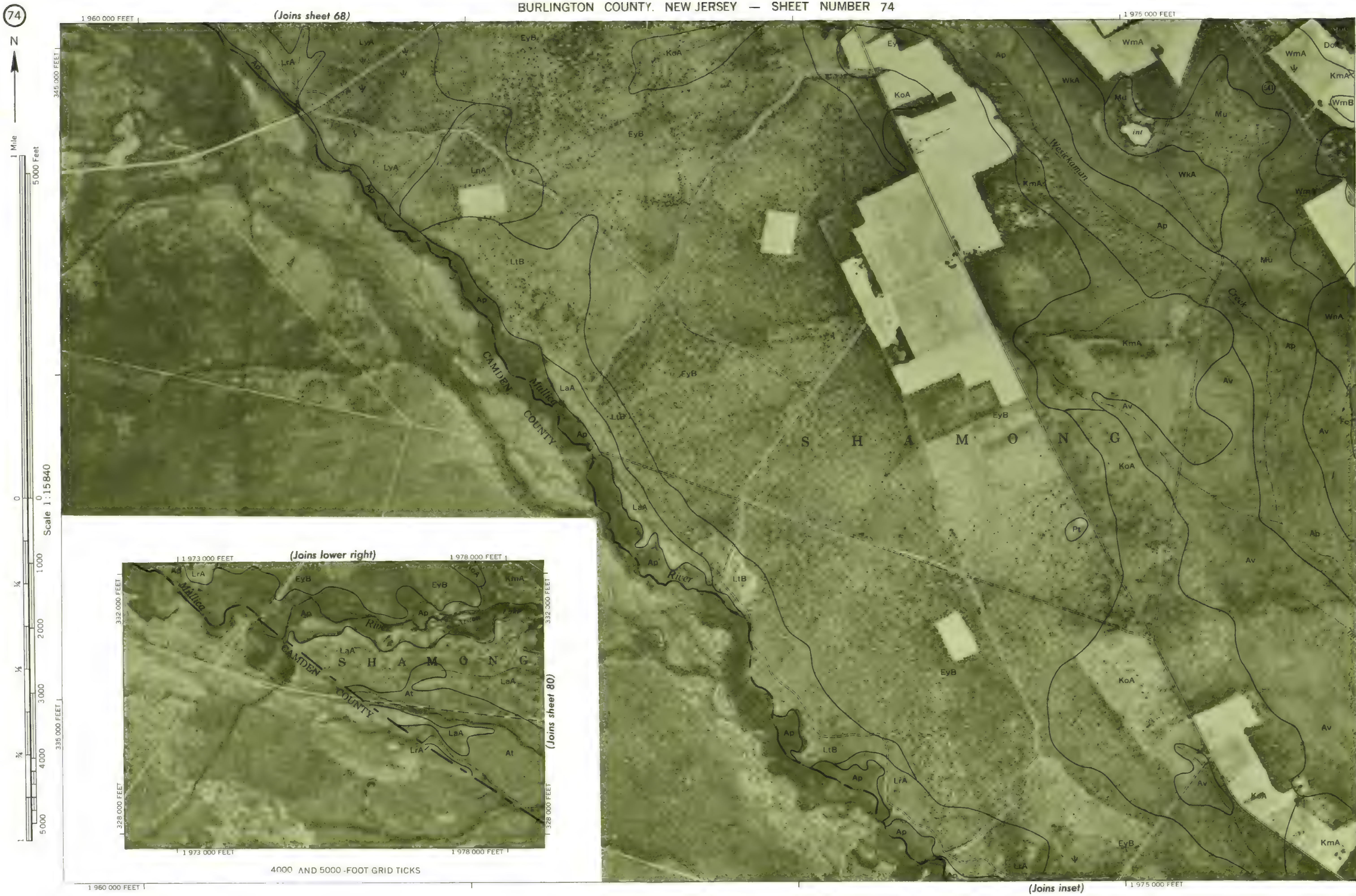


Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

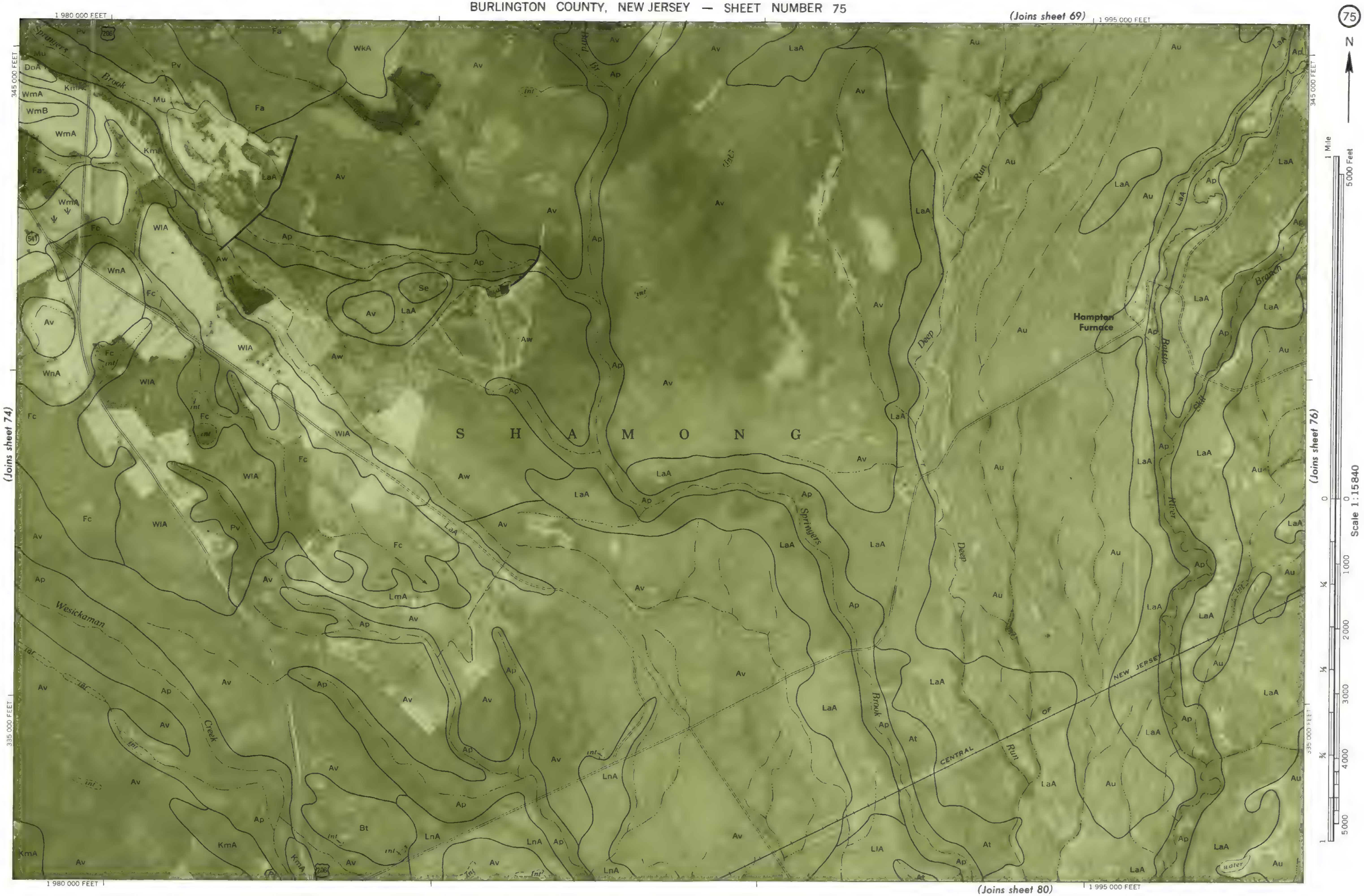
BURLINGTON COUNTY, NEW JERSEY NO. 73



BURLINGTON COUNTY, NEW JERSEY NO. 74

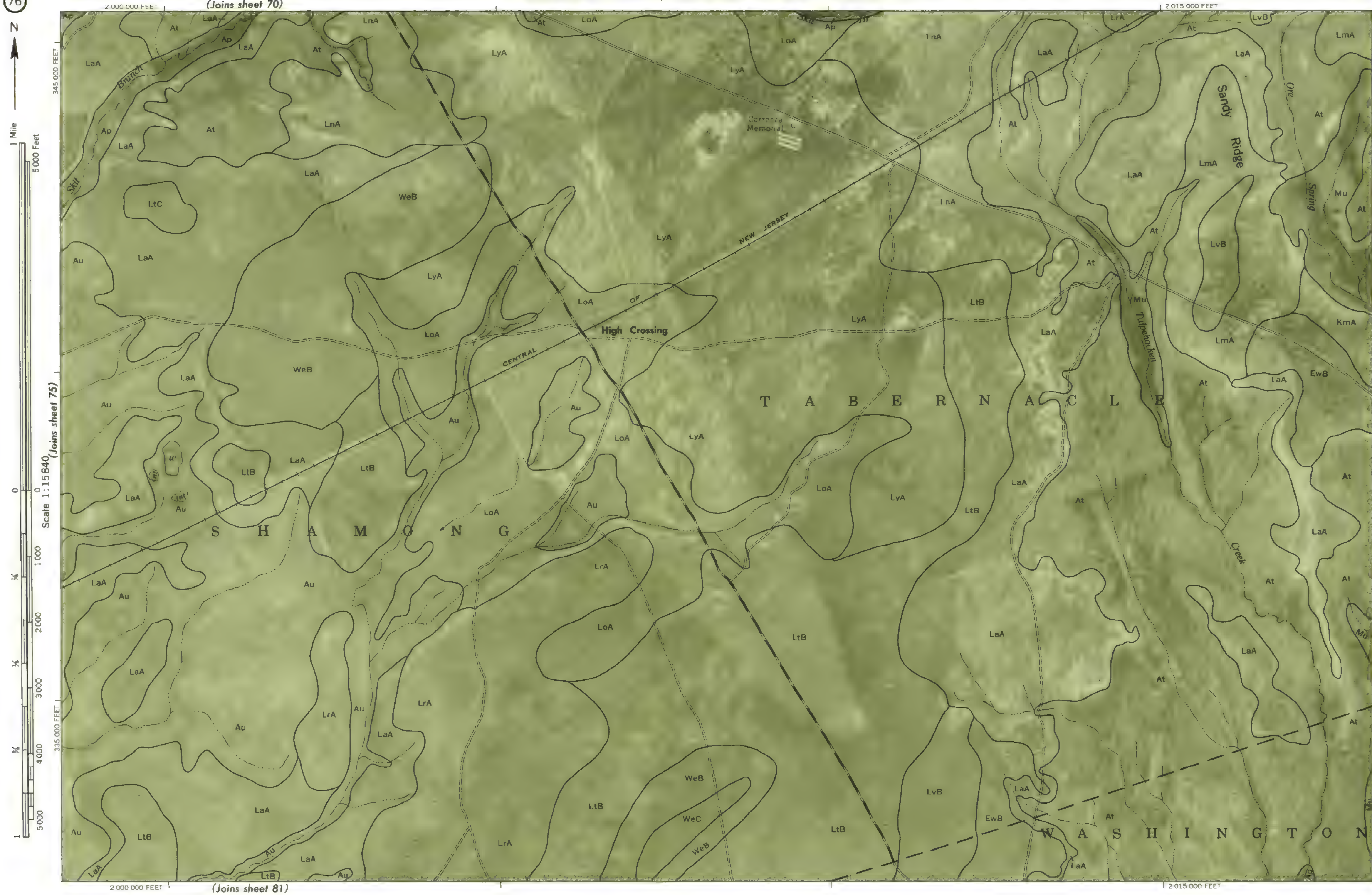
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station



BURLINGTON COUNTY, NEW JERSEY NO. 75

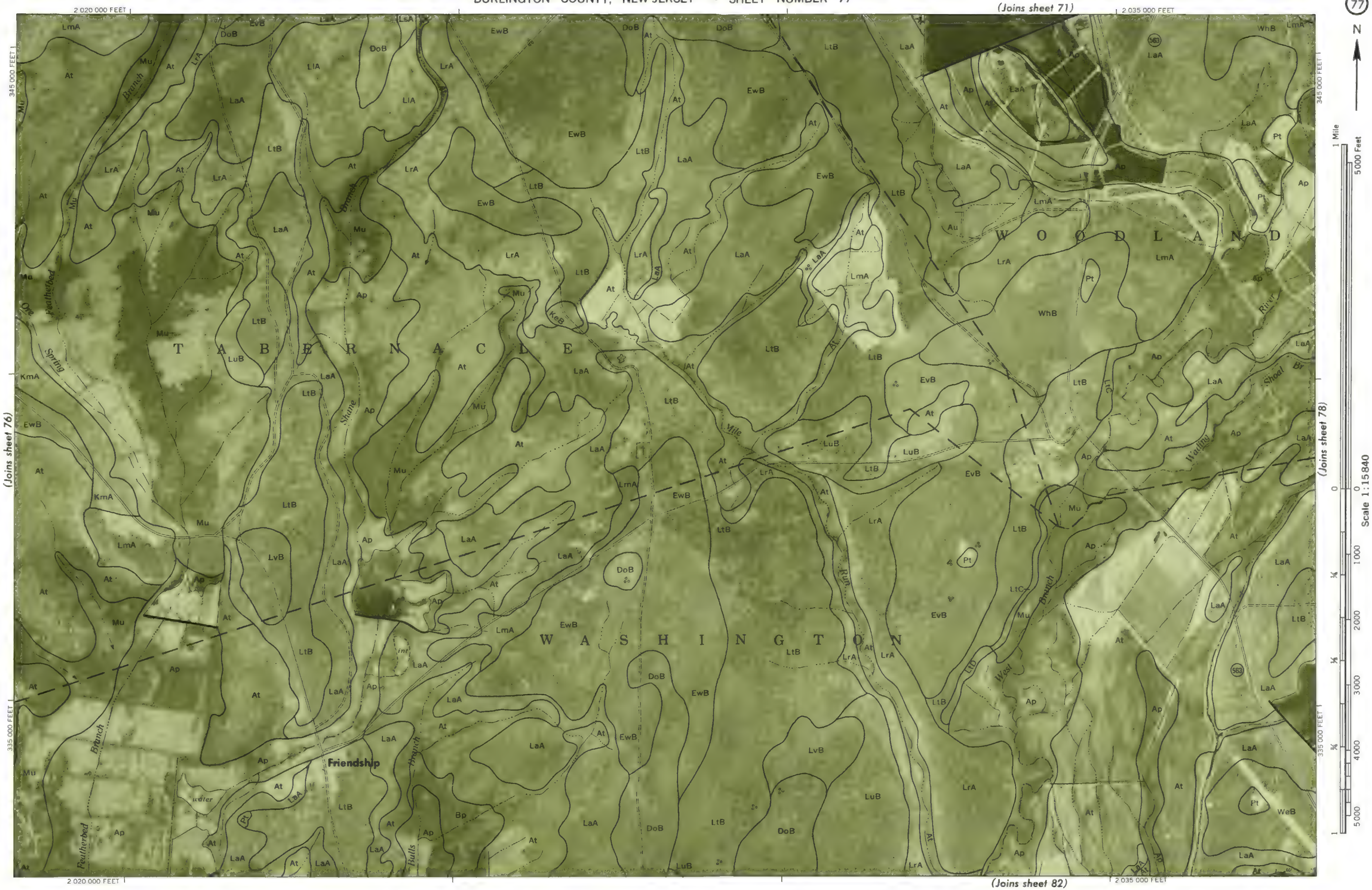
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.



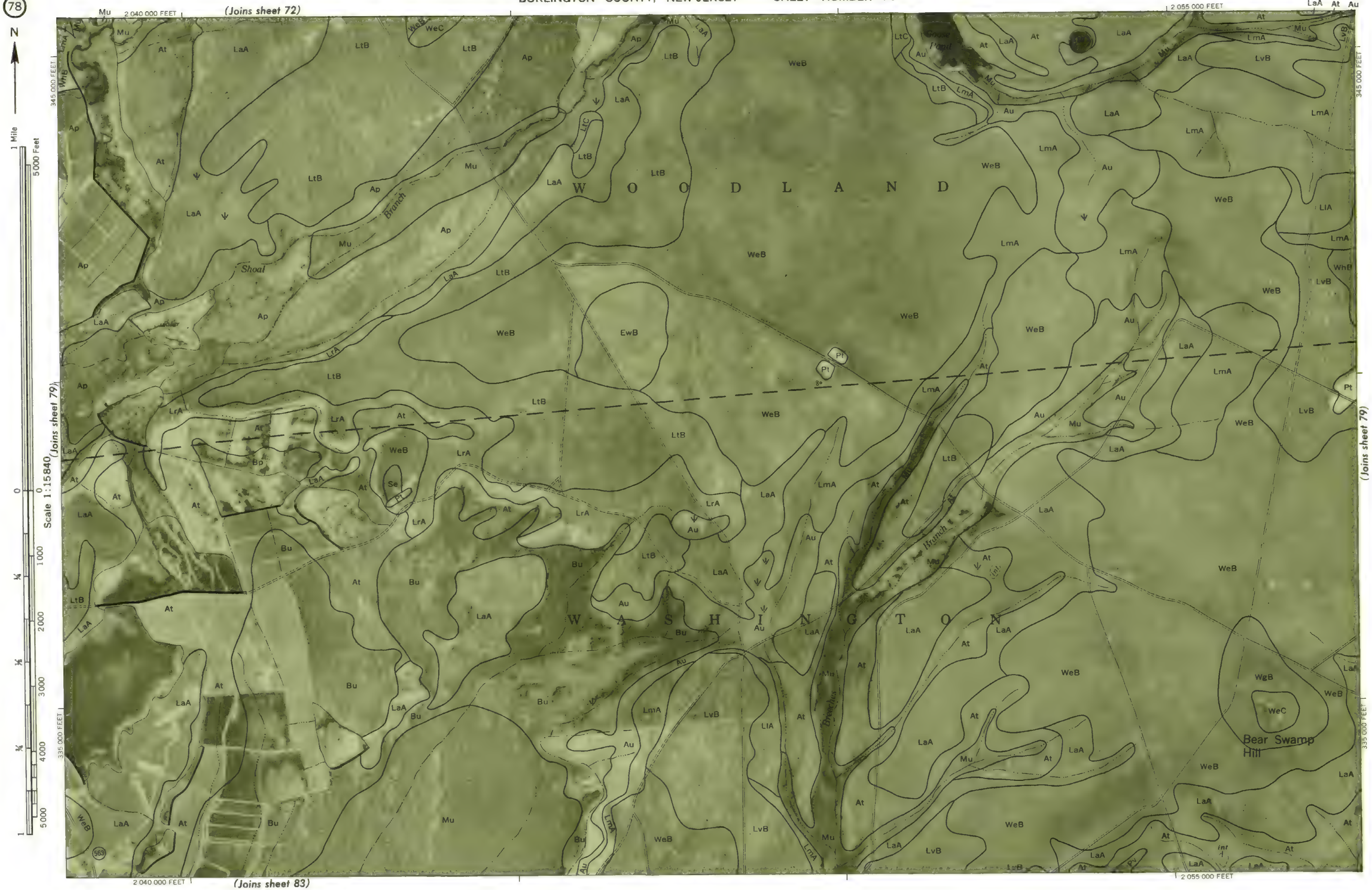
BURLINGTON COUNTY, NEW JERSEY NO. 76

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.



This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum



BURLINGTON COUNTY, NEW JERSEY NO. 78

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

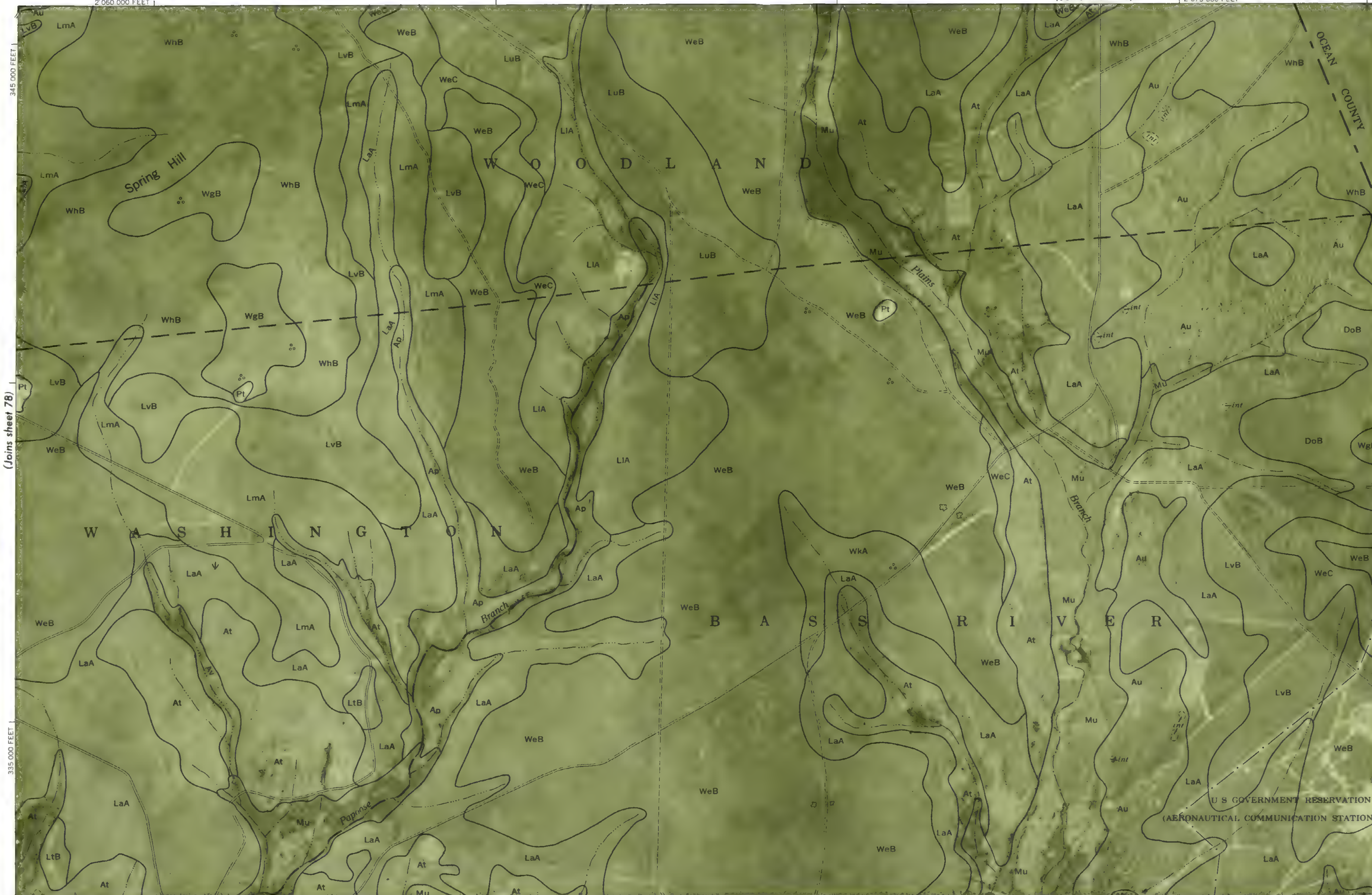
79

(Joins sheet 73)

2 060 000 FEET

2 075 000 FEET

345 000 FEET



(Joins sheet 78)

335 000 FEET

2 060 000 FEET

2 075 000 FEET

(Joins sheet 84)

N

1 Mile

5000 Feet

0

1000

2000

3000

4000

5000

Scale 1:15840

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 79

N

(Joins sheet 75)

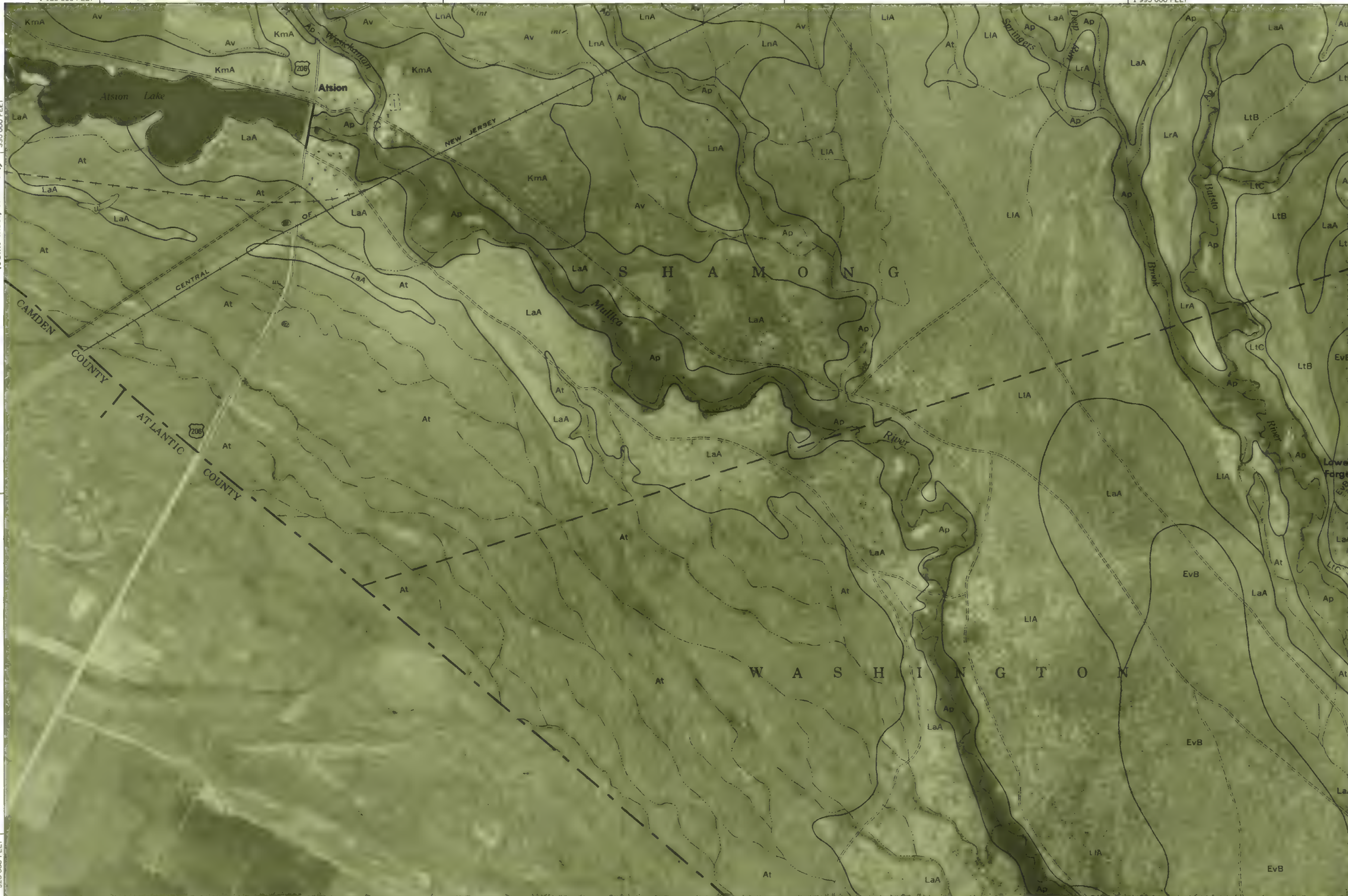
1 980 000 FEET

1 995 000 FEET

330 000 FEET

(Joins inset, sheet 74)

(Joins sheet 81)



320 000 FEET

1 980 000 FEET

(Joins sheet 85)

1 995 000 FEET

1 Mile

5000 Feet

Scale 1:15840

0 ¼ ½ ¾ 1

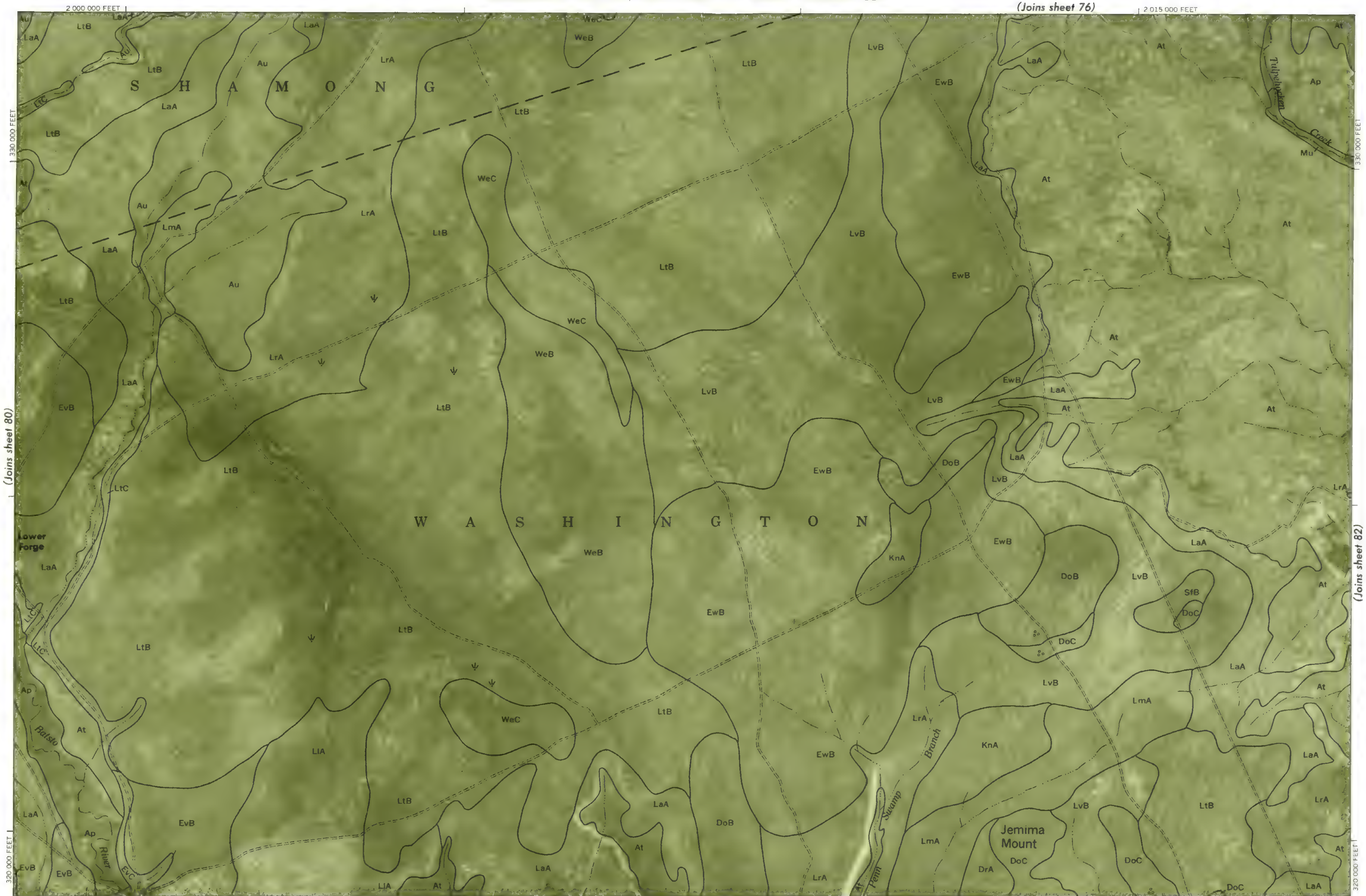
0 1000 2000 3000 4000 5000

BURLINGTON COUNTY, NEW JERSEY NO. 80

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(81)



N

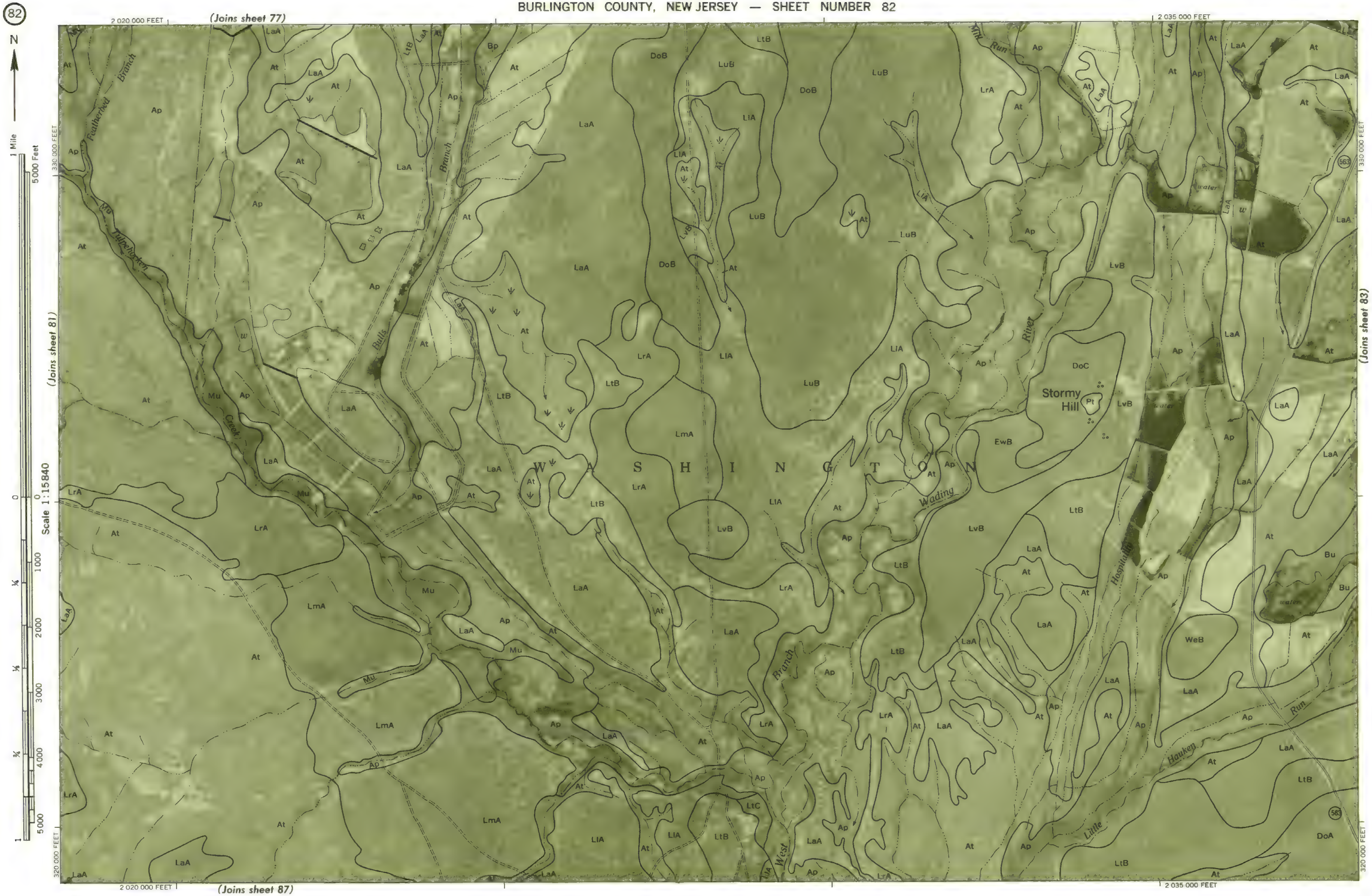
Scale 1:15 840

1 Mile | ¾ | ½ | ¼ | 0

5000 Feet | 4000 | 3000 | 2000 | 1000 | 0

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 81



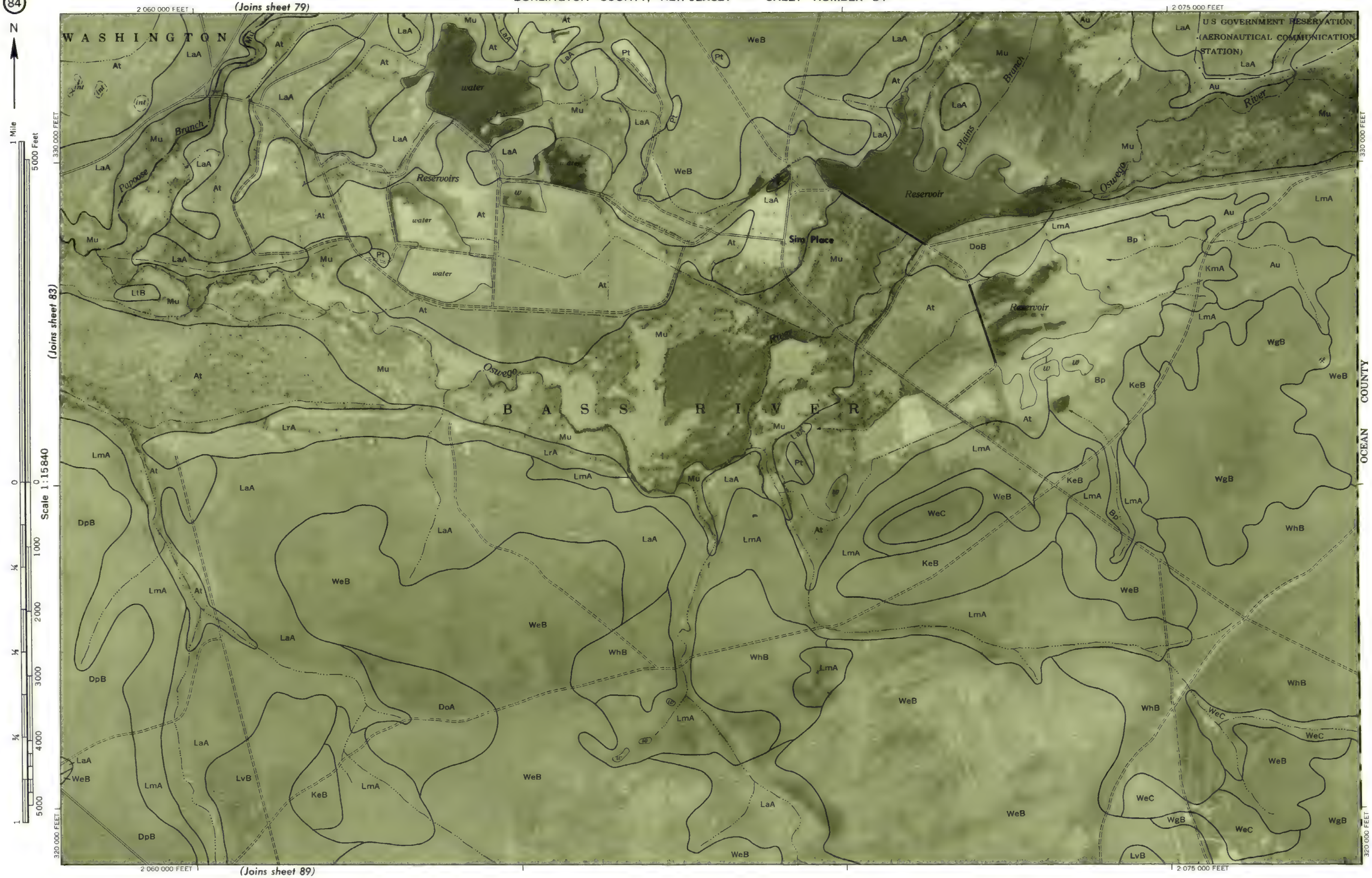
BURLINGTON COUNTY, NEW JERSEY NO. 82

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(Joins sheet 78)

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

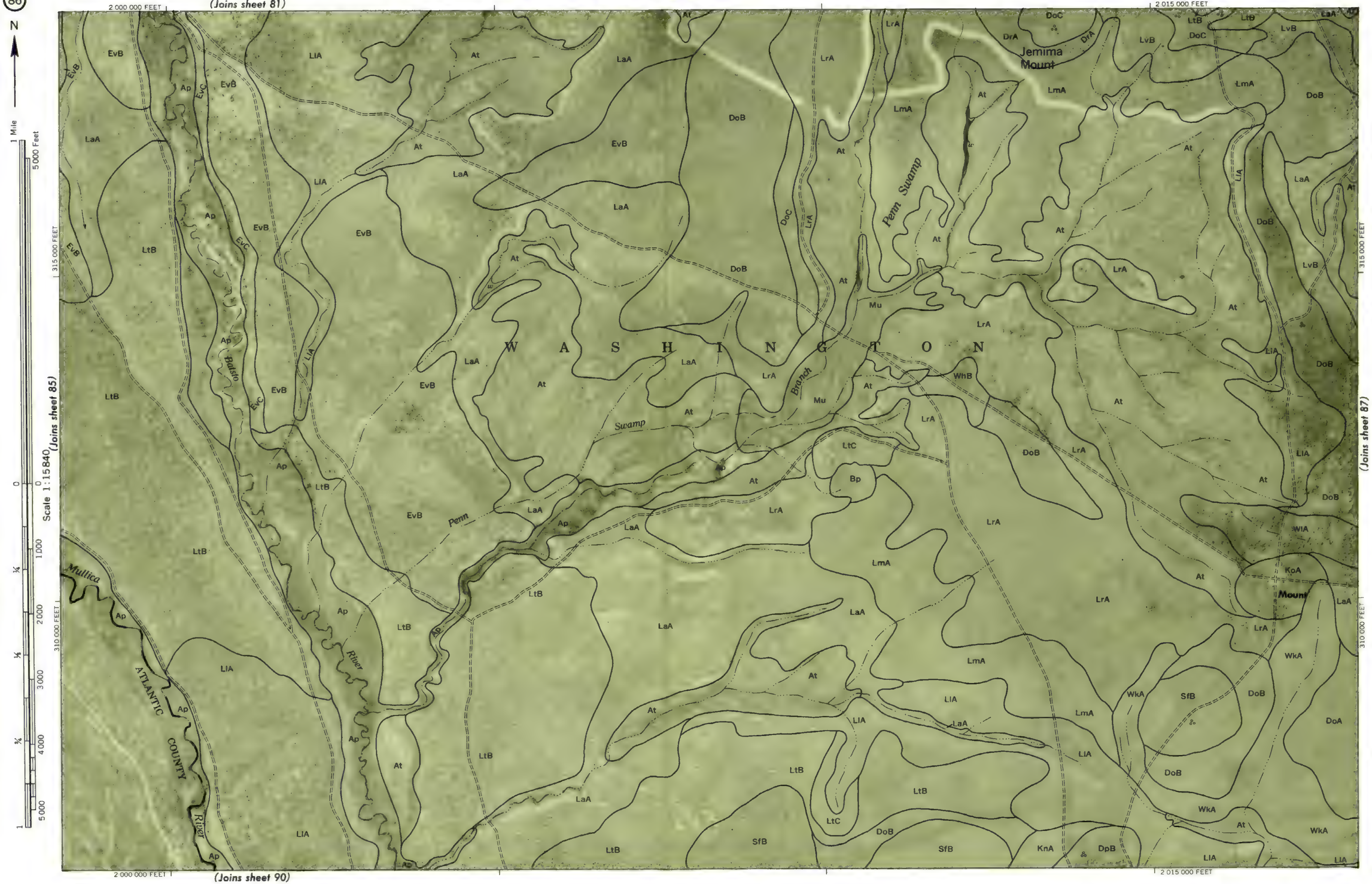


This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 86

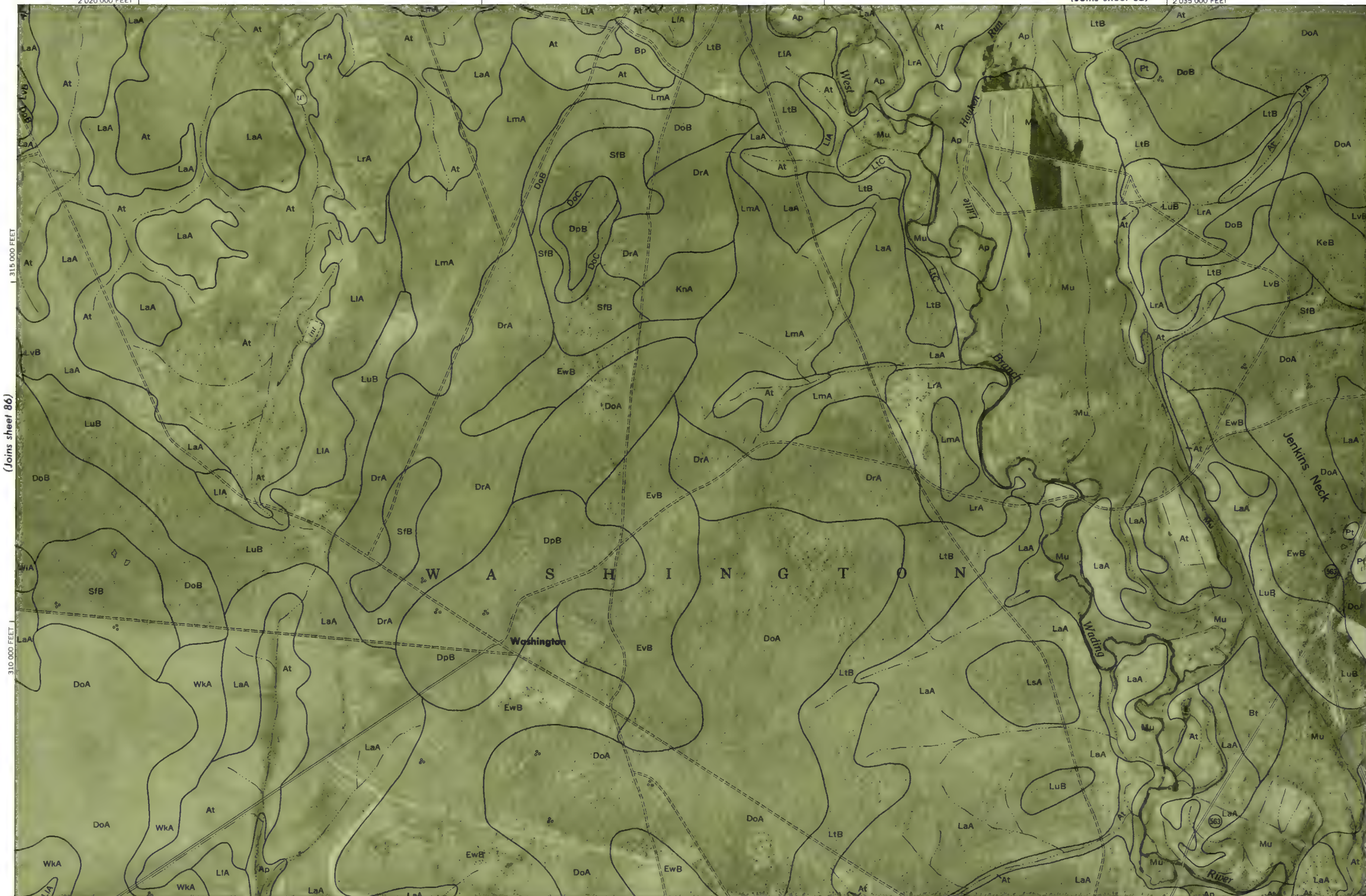


BURLINGTON COUNTY, NEW JERSEY NO. 86

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

87



This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

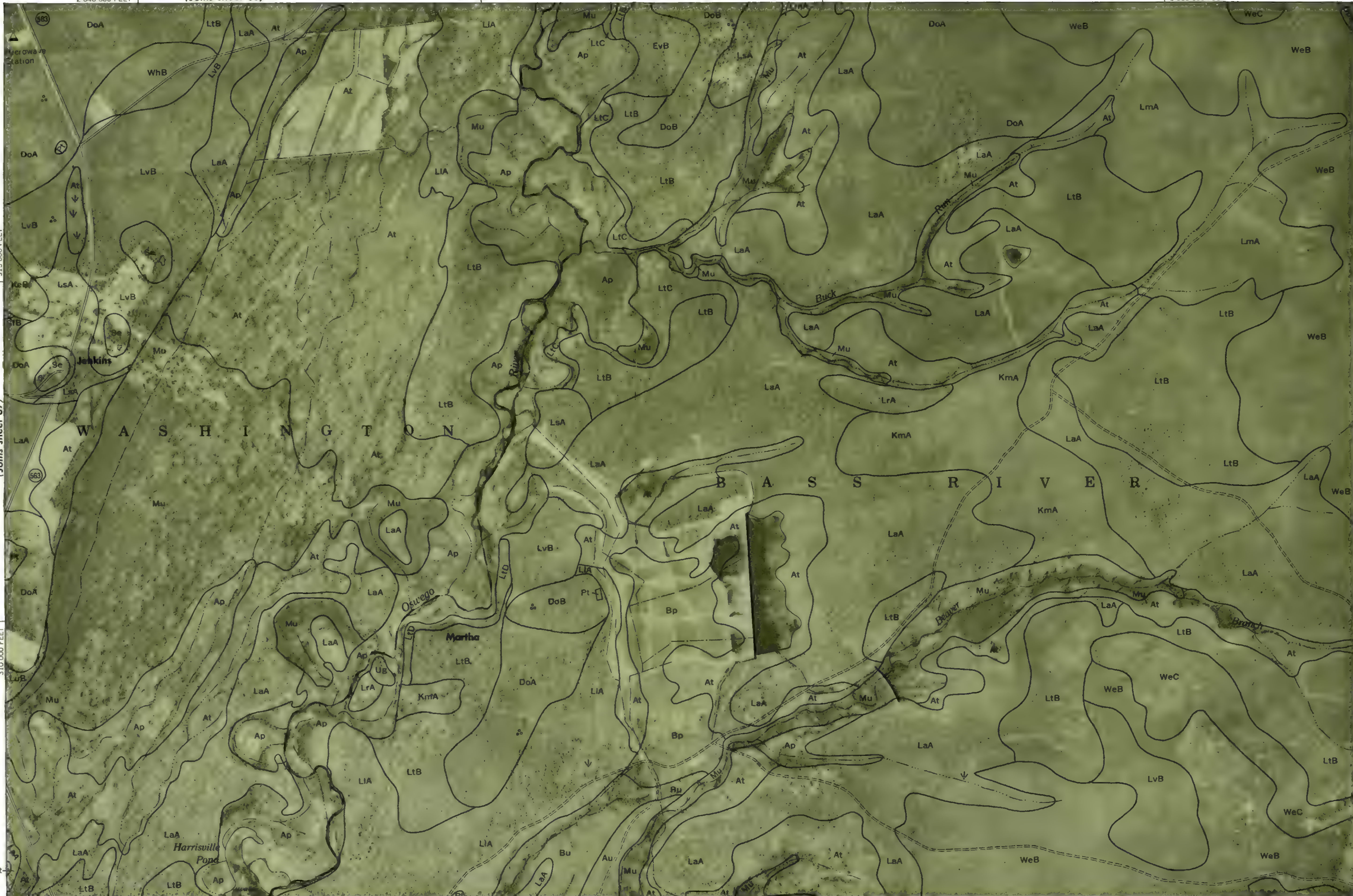
BURLINGTON COUNTY, NEW JERSEY NO. 87

1 Mile
5000 Feet
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000
Scale 1:15840

(88)

N

(Joins sheet 83)



(Joins sheet 87)

(Joins sheet 89)

(Joins sheet 92)

Scale 1:15 840

1 Mile ¾ ½ ¼ 0

5000 Feet 4000 3000 2000 1000 0

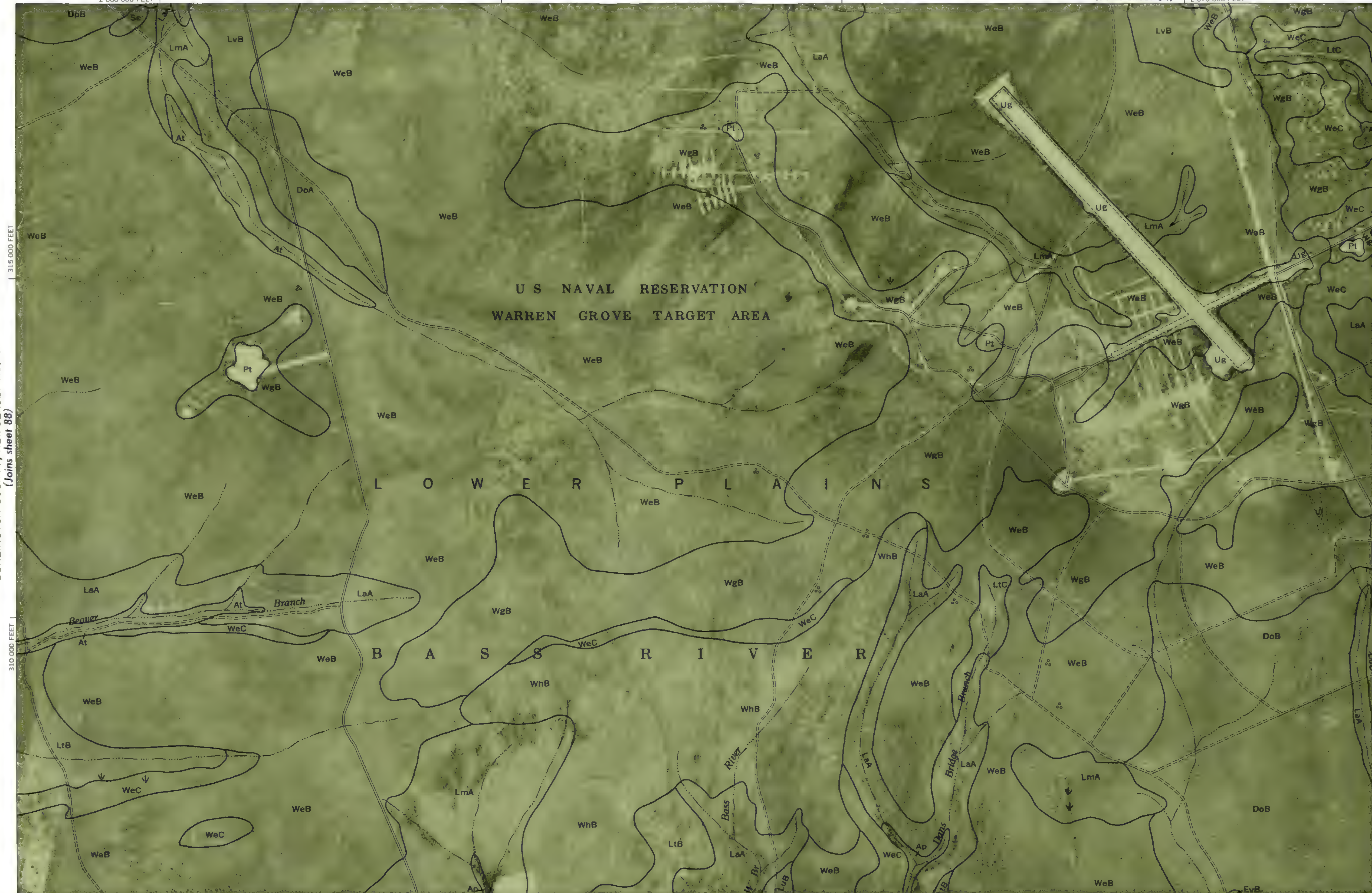
BURLINGTON COUNTY, NEW JERSEY NO. 88

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

89

(Joins sheet 84)



(Joins sheet 93)

N

1 Mile

5000 Feet

Scale 1:15840

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum

BURLINGTON COUNTY, NEW JERSEY NO. 89

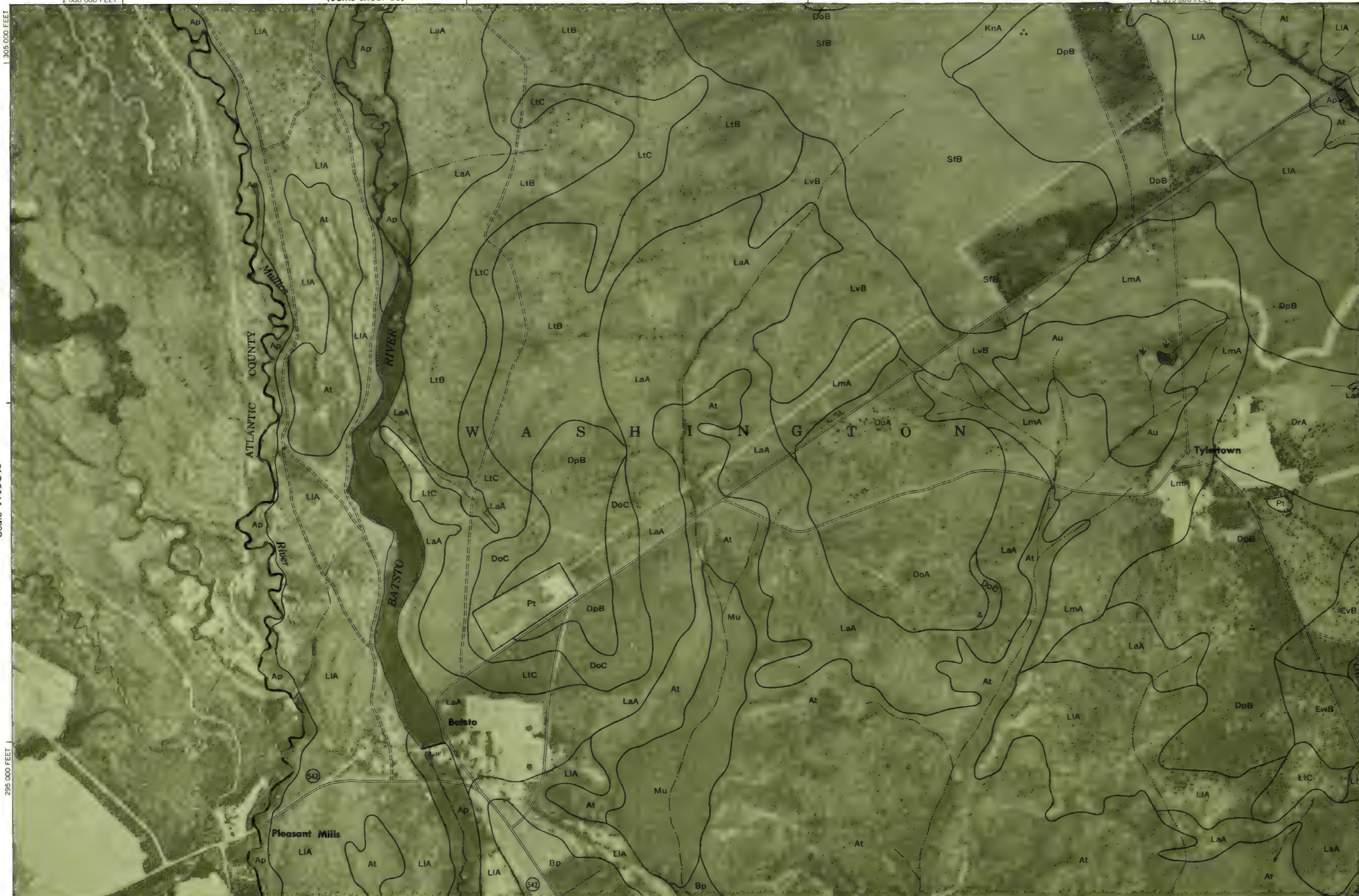
(Joins sheet 88)

(Joins sheet 86)

2 000 000 FEET

2 015 000 FEET

N



1 Mile

5000 Feet

Scale 1:15840

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins sheet 94)

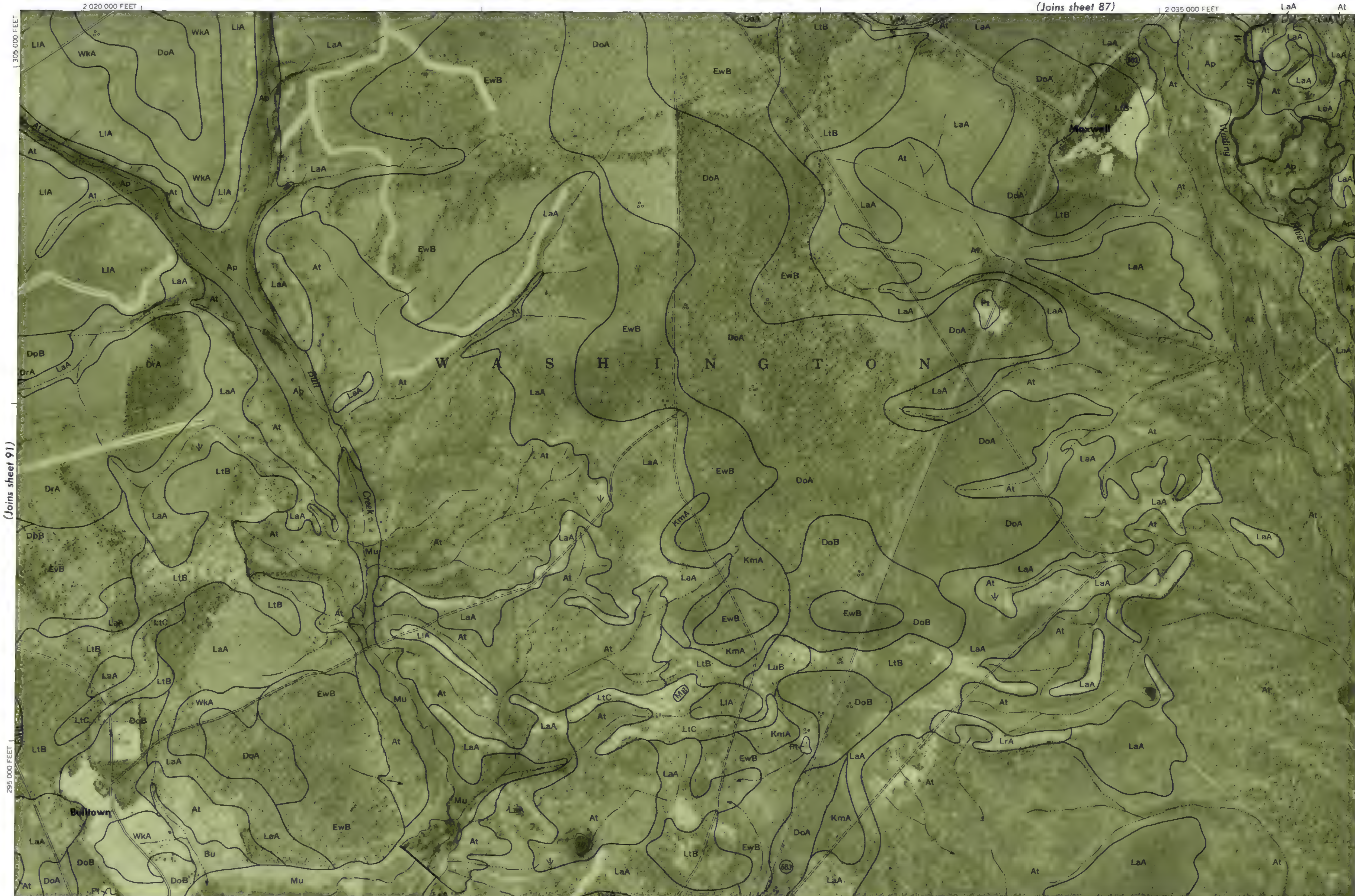
(Joins sheet 91)

BURLINGTON COUNTY, NEW JERSEY NO. 90

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(Joins sheet 87)



(Joins sheet 91)

(Joins sheet 92)

(Joins sheet 95)

N

Scale 1:15 840

1 Mile

5000 Feet

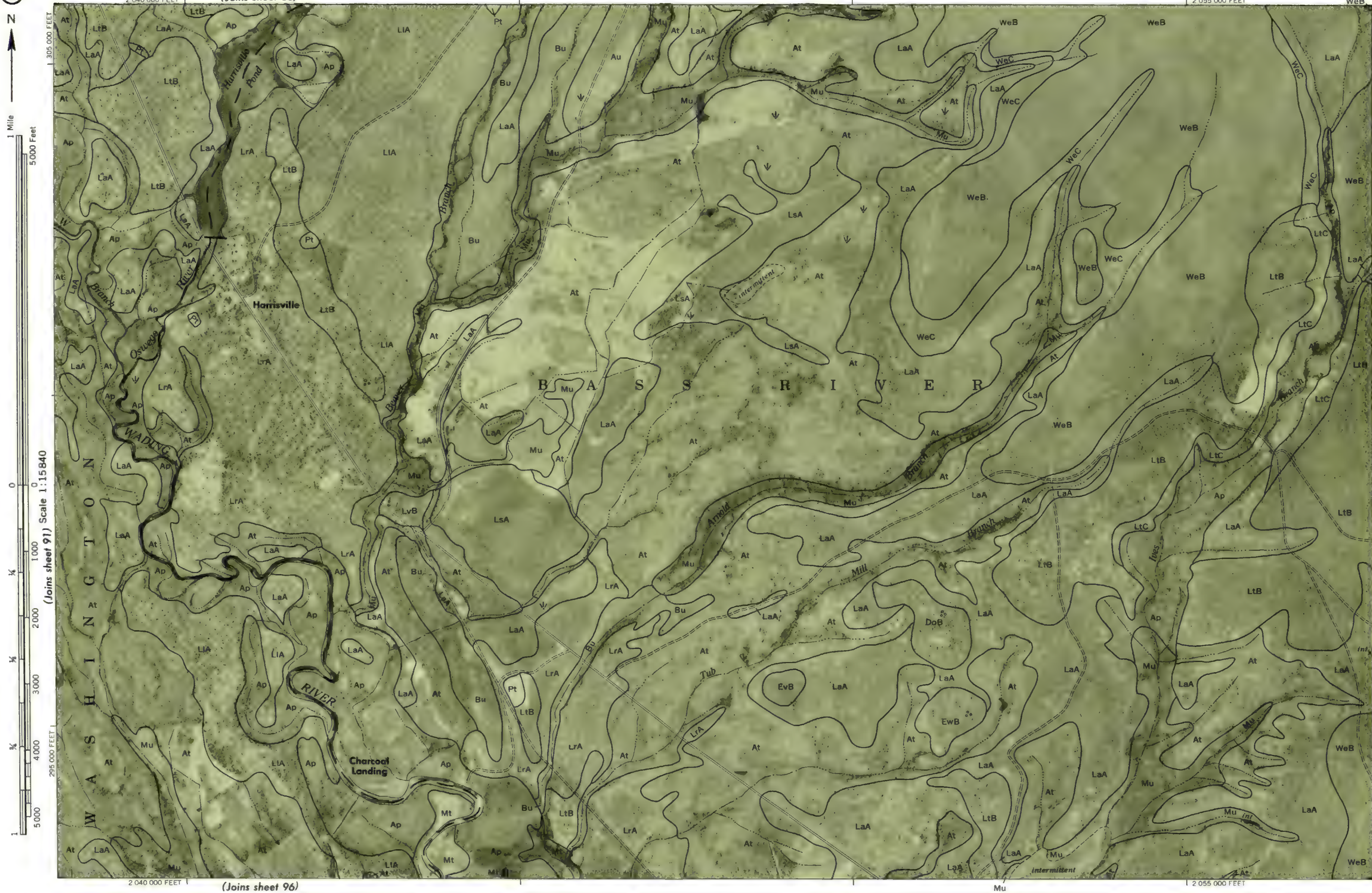
0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

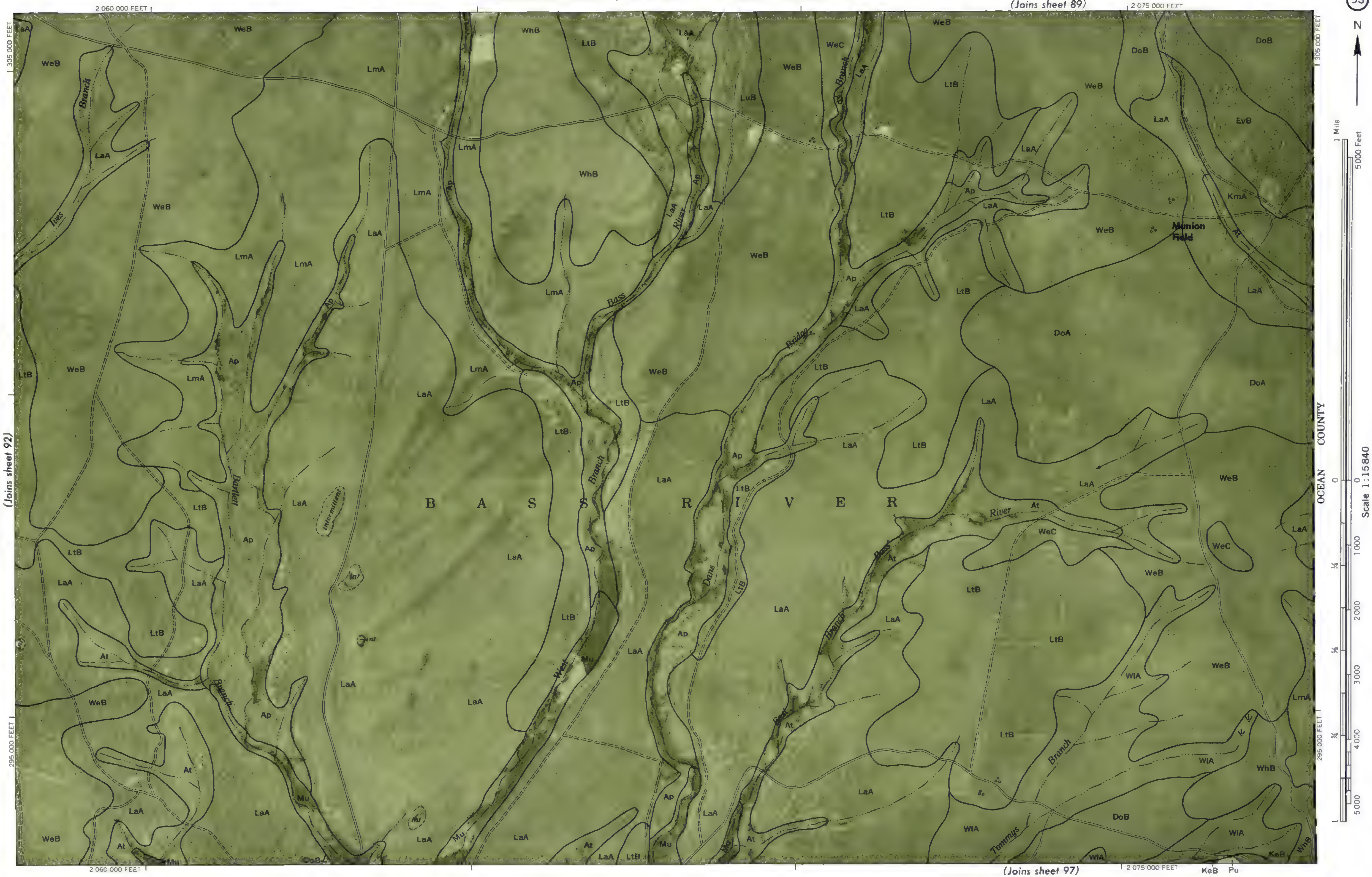
BURLINGTON COUNTY, NEW JERSEY NO. 91



BURLINGTON COUNTY, NEW JERSEY NO. 92

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.



This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum
BURLINGTON COUNTY, NEW JERSEY NO. 93

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 94

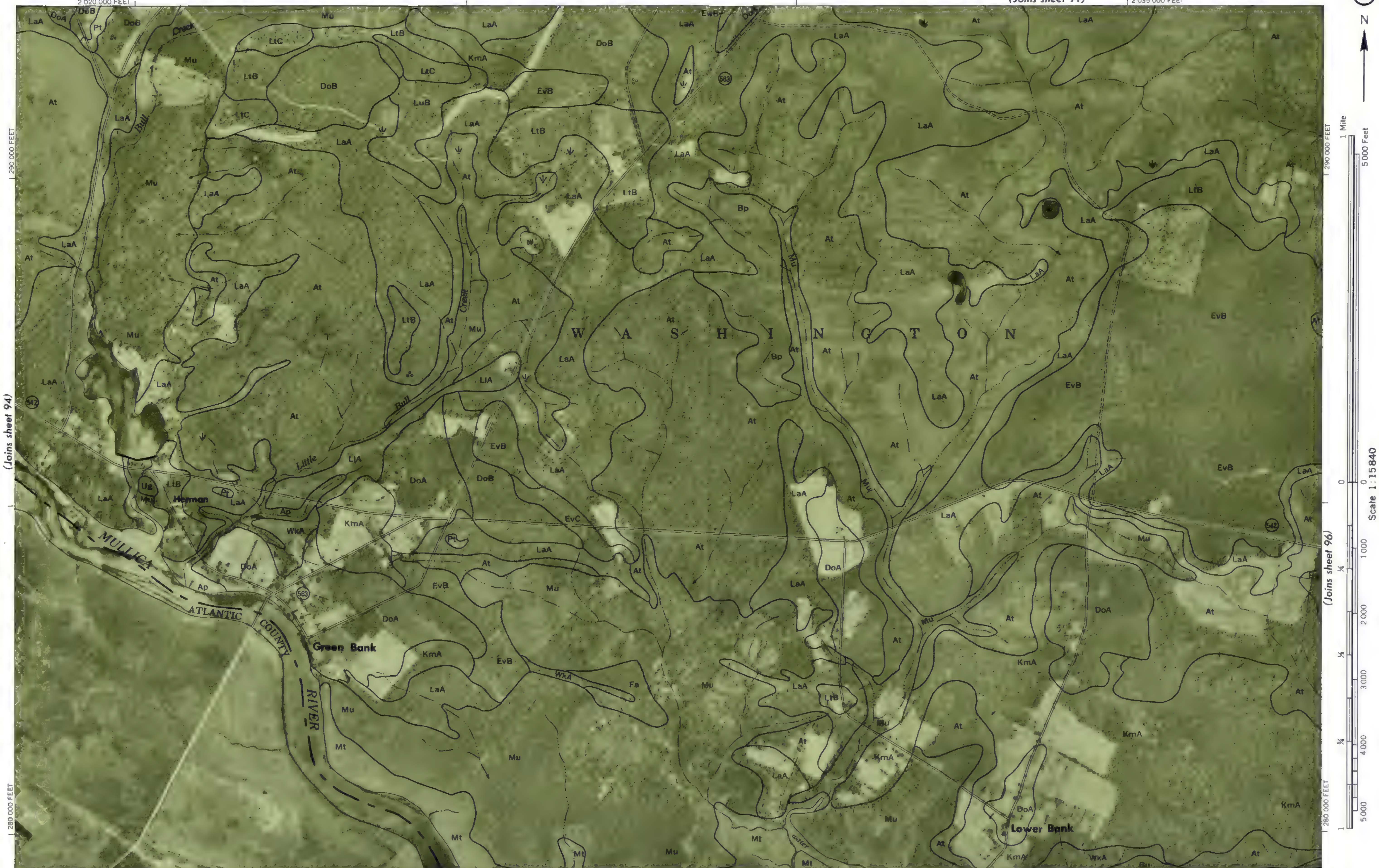
BURLINGTON COUNTY, NEW JERSEY NO. 94

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station

95

(Joins sheet 91)



(Joins sheet 94)

(Joins sheet 96)

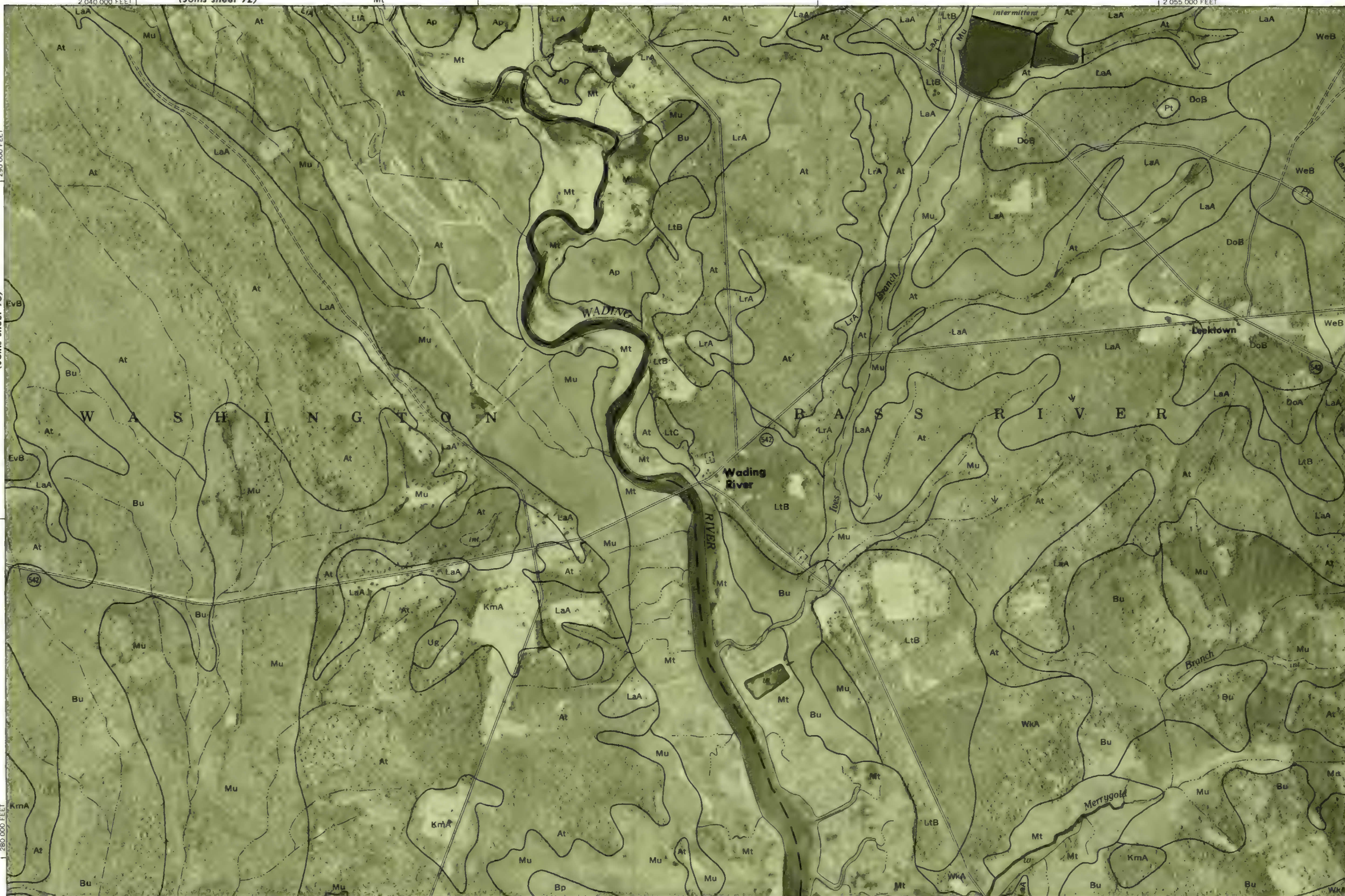
(Joins sheet 98)

BURLINGTON COUNTY, NEW JERSEY NO. 95

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 96

(Joins sheet 92)



(Joins sheet 95)

(Joins sheet 97)

(Joins sheet 99)

N

Scale 1:15 840

1 Mile — ½ — ¼ — 0

5000 Feet — 4000 — 3000 — 2000 — 1000 — 0

BURLINGTON COUNTY, NEW JERSEY NO. 96

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system, 1927 North American datum.

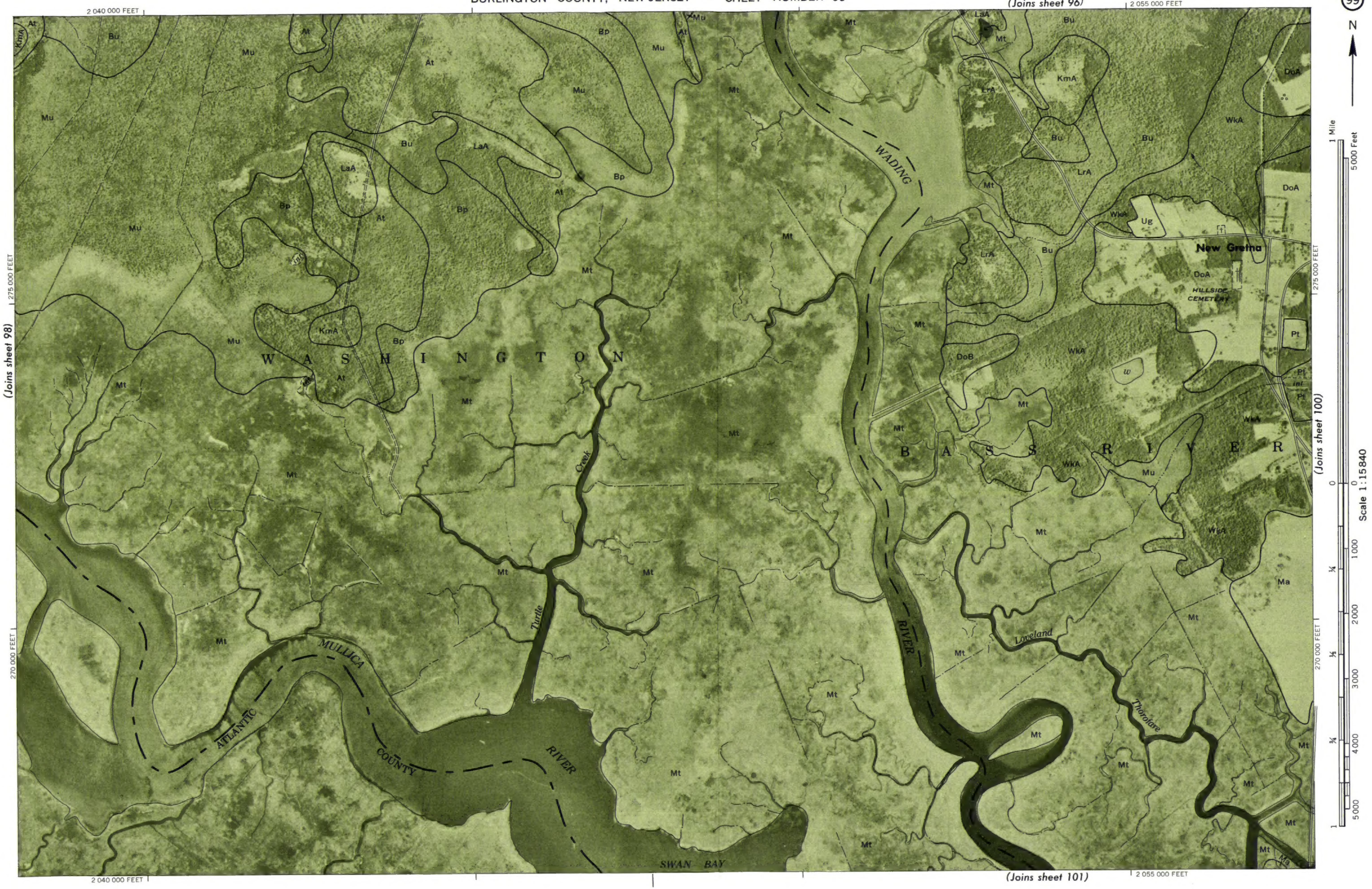
BURLINGTON COUNTY, NEW JERSEY NO. 97

BURLINGTON COUNTY, NEW JERSEY — SHEET NUMBER 98

BURLINGTON COUNTY, NEW JERSEY NO. 98

Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.



This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photo base from 1963 aerial photographs. 5,000-foot grid ticks based on New Jersey plane coordinate system. 1927 North American datum.

BURLINGTON COUNTY, NEW JERSEY NO. 99

BURLINGTON COUNTY, NEW JERSEY

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Dual
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State or county

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail
- Railroad
- Ferry — FY
- Ford — FORD
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings

- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Microwave tower

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport

DRAINAGE

Streams, double-line

- Perennial
- Intermittent

Streams, single-line

- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches — CANAL

Lakes and ponds

- Perennial — water, w
- Intermittent — int

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

RELIEF

Escarpments

- Bedrock
- Other

Prominent peak

Depressions (Large, Small)

- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol — Dx
- Gravel
- Ironstone
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Area where B horizon has been removed or mined for molding sand
- Short steep slope